MATHEMATICS 9

Module 7: Data Management

Distance Learning

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Mathematics 9

Module 7

DATA MANAGEMENT

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Mathematics 9
Student Module
Module 7
Data Management
Alberta Distance Learning Centre
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Welcome to Module 7!

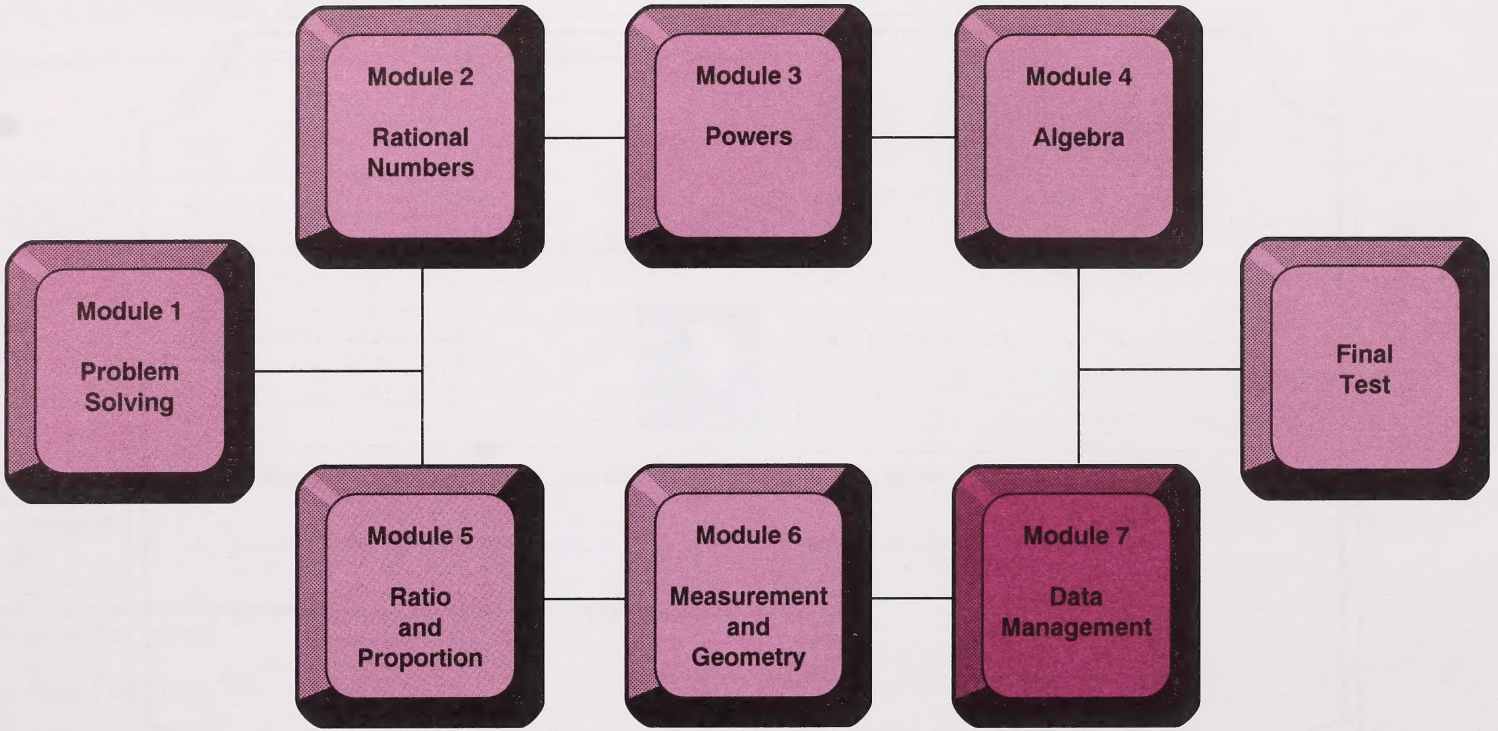
We hope you'll enjoy your study of ***Data Management****.*

To make your learning a bit easier, a teacher will help guide you through the material.

So whenever you see this icon, turn on your audiocassette and listen.

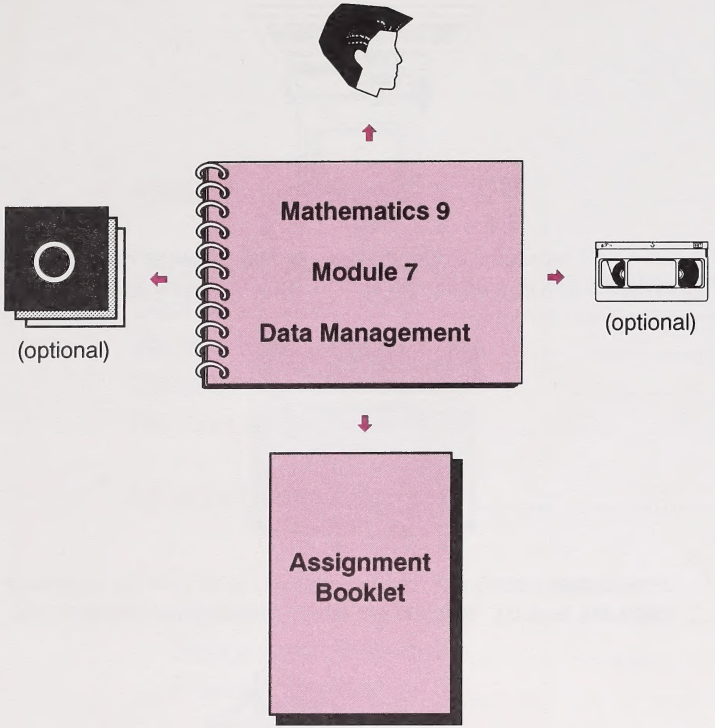
Turn the audiocassette on now to begin.

Course Overview



Mathematics 9 has seven modules and a final supervised test.

Module 7 Components



This booklet will give you instruction and practice in learning mathematical skills and words. It will also direct you to the other components of the module: the companion audiocassette, the videocassettes, the computer software, and the Assignment Booklet.

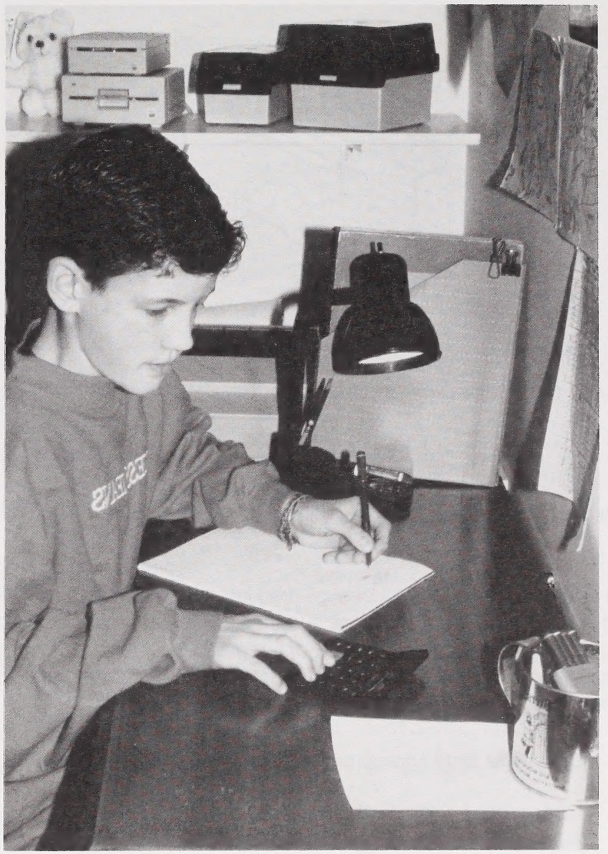
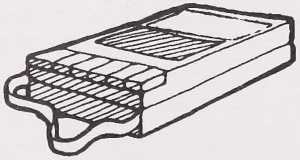


Photo Search Ltd.

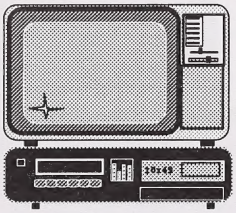
There are no response spaces provided in this Student Module Booklet. This means that you will need to use your own paper for your responses. You should keep your response pages in a binder so that you can refer to them when you are reviewing or studying.

Optional Equipment

The companion audiocassette for this module is optional. If you decide to listen to it, you will need an audiocassette player.



The video activities in this module are optional. To view the video programs, you will need a videocassette player and a television.



The computer activities in this module are optional. If you decide to do the computer activities, you will need an Apple computer.

Required Equipment

You will need a geometry set and a calculator for this module. The calculator should have an $a\frac{b}{c}$ key so that you can perform operations on fractions.

Evaluation

Your mark on this module will be determined by your work in the Assignment Booklet.

Your responses to the questions in this Student Module Booklet are not to be submitted for a grade. However, it is important that you work through the activities carefully before attempting the questions in the Assignment Booklet. This will help you achieve a greater degree of success in your studies.

Discuss how the module will be evaluated with your learning facilitator.

Time Management

Decide how long you will need to complete the module. Your learning facilitator will help you plan a schedule.

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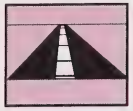


What Lies Ahead

In the module introduction you will preview Module 7.

Working Together

Every day you are bombarded with numerical information from newspapers, magazines, radio, and television.

Some of the pieces of numerical information are presented in sentences like these.

- Canada's population has doubled since 1951.
- About 22% of all trout caught in Alberta are cutthroat.
- Wayne Gretzky was the first hockey player to reach 2000 points and the fourth to score 700 goals.
- The divorce rate in Canada is 2.4 divorces per 1000 people.
- During the Great Depression, 1 out of 4 people was out of work.
- There is a 75% chance of rain.

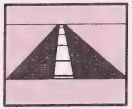
Sometimes the pieces of numerical information are displayed in charts and graphs.

These pieces of numerical information are called **data**. The word *data* is plural, but hardly anyone uses the singular form *datum*, which refers to only one number or piece of information.

Statistics is the science of collecting, organizing, and drawing conclusions from data.

For many people the first word that comes to mind when they think of statistics is "lies". Statistics, like other forms of communication, can be used to mislead people. However, most researchers try very hard to be as accurate as possible.

In this module you will learn how to manage data properly and how to recognize the misuse of statistics.



What Lies Ahead

This section will pretest the skills taught in this module.

Working Together

The Pretest in this section will help you and your learning facilitator to determine your strengths and weaknesses and individualize your learning plan.

Pretest

1. The 25 students in Grade 9C were asked how many fillings they had in their teeth during their lifetimes.

Their responses are shown in the following list.

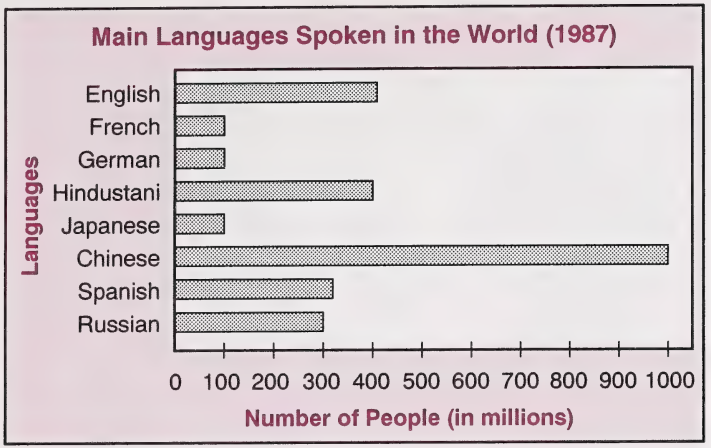
3	5	8	2	0
6	7	4	4	8
6	1	1	4	6
3	0	7	4	1
2	3	0	0	0

a. Complete a chart like the one shown and find the frequency for each number of fillings.

Survey of Grade 9C Students		
Number of Fillings	**Tally**	**Frequency**
0		
1		
2		
3		
4		
5		
6		
7		
8		

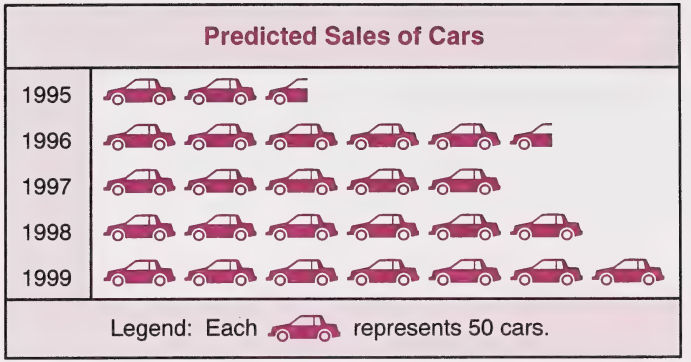
b. Find the mean.
c. Find the median.
d. Find the mode.
e. Find the range.
f. Jason is in Grade 9C. If he has 5 fillings, what percentile is he in?

2. Use the graph to answer the following questions.



a. Which language is spoken by the greatest number of people?
b. About how many people speak English?
c. About how many people speak French?

3. Super Charge Vehicles Ltd. are predicting their sales of electric cars. The first automobile will be a four-seat Hummalong. With its large battery, it is expected to go 250 km before the battery needs to be recharged. Recharging should only take 1.5 h. The predicted sales are displayed in the following graph. Use the graph to answer the following questions.

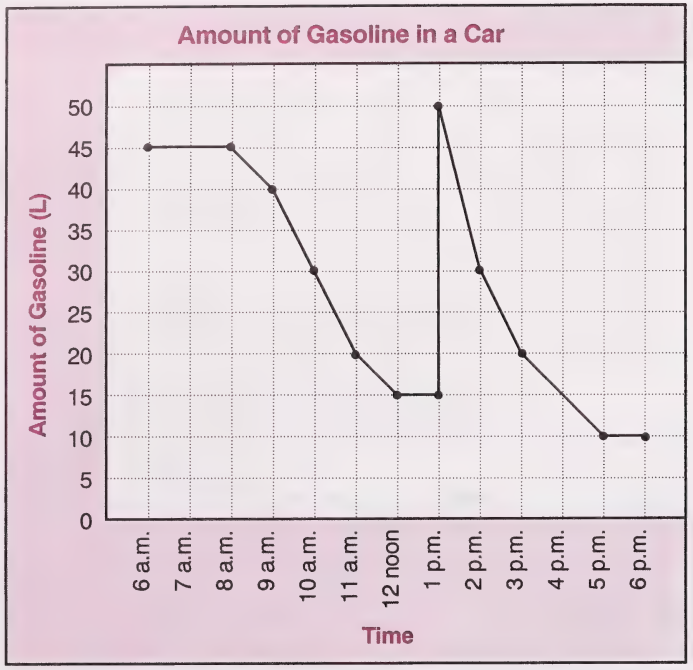


a. How many cars are represented by ?

b. In which year should the sales be over 300 vehicles?

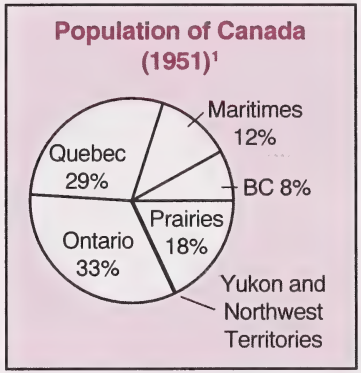
c. If each car sells for $16 000, how much does the company expect to earn in 1995?

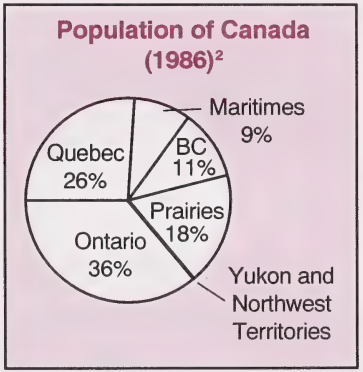
4. Use the graph to answer the following questions.



a. When did the driver leave home?
b. When did the driver eat lunch?
c. When did the driver arrive home?
d. What do you think the driver does for a living? Why?
e. When did the driver fill up the gas tank?
f. How much gas did the driver purchase?
g. What is the capacity of the tank?
h. How much gas is left in the tank at 6 p.m.?

5. Use the graphs to answer the following questions.





Note: The Yukon and Northwest Territories are included as lines on these graphs because their combined population is less than 1% of the total population of Canada.

a. In what regions of the country did the percent of population increase from 1951 to 1986?

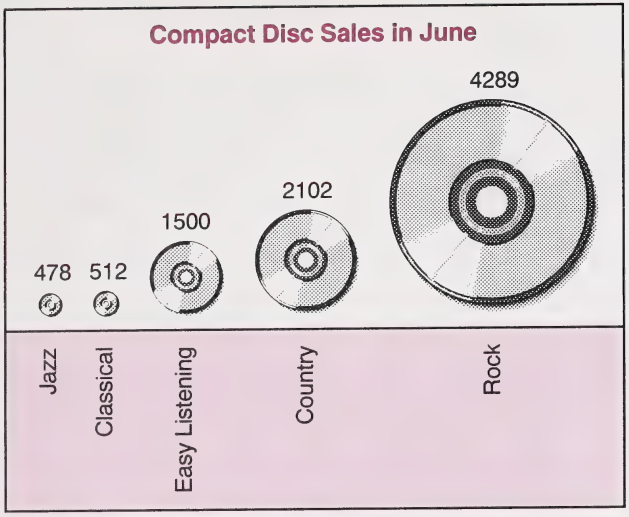
b. If the total population of Canada in 1951 was 14 009 000, what was the population of the Prairies?

c. If the total population of Canada in 1986 was 25 354 000, what was the population of the Prairies?

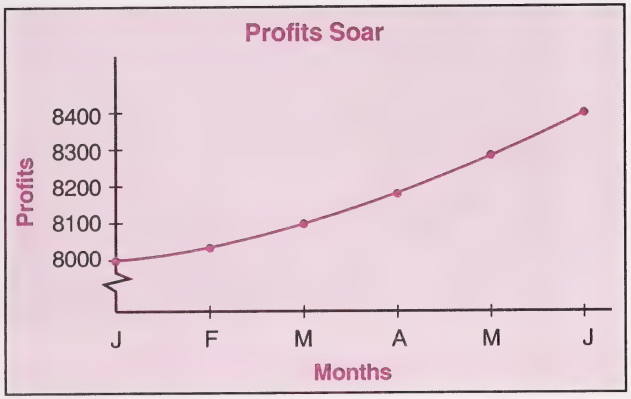
[1, 2] Statistics Canada

6. Explain why each of the following graphs is misleading.

a.



b.



7. Define the following terms used in statistics.

a. population
b. census
c. sample
d. biased sample
e. random sample

8. **a.** Greta wants to discover how many people in her town can swim. Explain how she could conduct a census to determine this.

b. Explain how Greta could use sampling to estimate the number of people in her town who can swim.

9. Raymond wants to discover how far from school the students at his school live. Which of the following sampling techniques would produce more accurate results? Why?

- Raymond asks every third student who gets off the school bus, "How far from school do you live?"
- Raymond asks every fifth student entering the school, "How far from school do you live?"

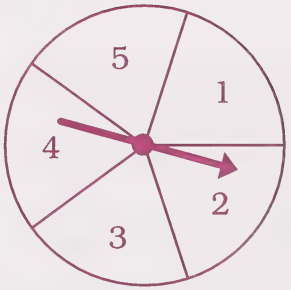
10. There are 592 people who have library cards at Cumberland library. Randy decides to mail a questionnaire to card holders to ask their opinion about purchasing more foreign language books. Which of the following sampling techniques would produce more accurate results? Why?

- Mail questionnaires to five card holders whose names are selected at random from a list.
- Mail questionnaires to 60 card holders whose names are selected at random from a list.

11. What is the probability that a car registered in Canada in 1986 had an Albertan owner? Base your answer on the following information.

Automobiles Registered in Canada in 1986	
Province	**Number**
Newfoundland	176 000
Nova Scotia	337 000
Prince Edward Island	56 000
New Brunswick	286 000
Quebec	2 614 000
Ontario	4 244 000
Manitoba	527 000
Saskatchewan	389 000
Alberta	1 296 000
British Columbia	1 527 000
Territories	25 000
Total	11 477 000

12.



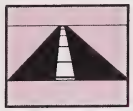
This spinner has five numbers on it. If the spinner is spun, what is the probability of each of the following events happening?

a. landing on 2
b. landing on an even number

13. The letters D, A, T, and A are placed on squares of paper and put in a bag. If two letters are chosen without looking, what is the probability of each of the following events occuring?

a. picking two As
b. picking two consonants
c. picking a vowel and a consonant

See your learning facilitator to check your answers and to receive further instructions.



What Lies Ahead

In this section you will learn these skills.

- finding frequency and percent distribution
- counting frequency with tallies
- recording frequency in tables
- interpreting pictographs, bar graphs, line graphs, and circle graphs
- recognizing graphs that misrepresent data

Working Together

Data is numerical information about people, animals, places, and events. One type of data that is often of interest to people is the **frequency** of an event. The frequency is the number of times a particular action or event has occurred.

Example 1

Lucy Fernandez asked 70 teenagers, "What is your favourite food?" She counted the responses using tallies and recorded the data in a table like the one shown.

Favourite Foods		
Food	**Tally**	**Frequency**
Italian	𝍸𝍸𝍸𝍸	17
Chicken	𝍸	6
Chinese	𝍸𝍸𝍸	15
Steak	𝍸𝍸𝍸𝍸	16
Mexican	𝍸	6
Burgers	𝍸	8
Other	||	2

This column adds up to 70.

Example 2

The staff at the Calgary Zoo recorded the number of visitors to the zoo from June to September 1988 when the panda bears were at the zoo.

They recorded the number of visitors in a table.

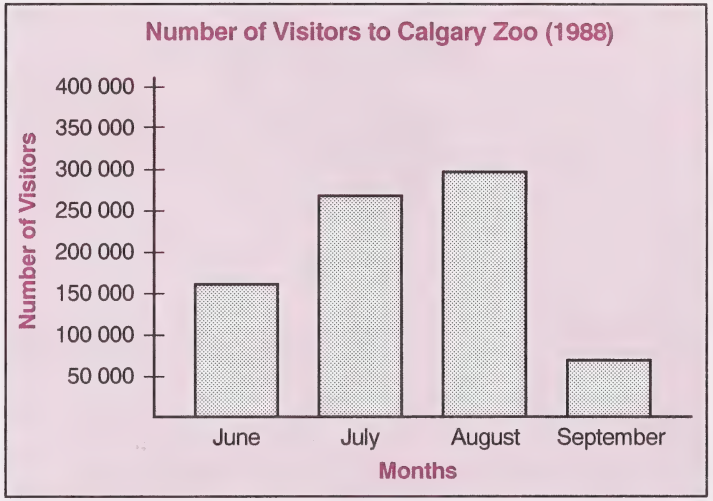
Number of Visitors to Calgary Zoo (1988)[1]	
Month	**Attendance**
June	162 184
July	268 726
August	296 330
September	71 940

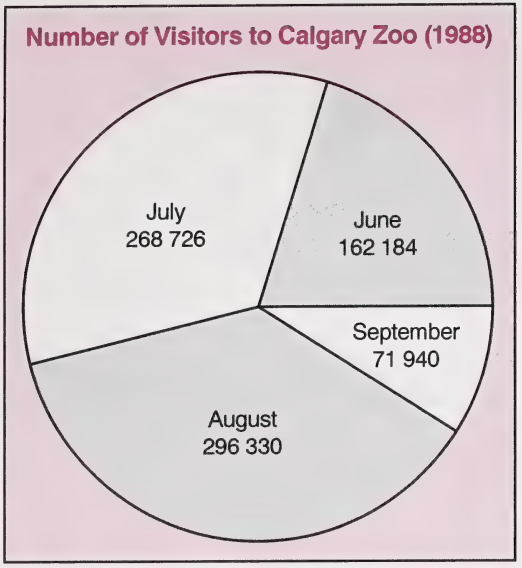
This column adds up to 799 180.

Compare the following graphs. They all display the same information.

Number of Visitors to Calgary Zoo (1988)	
June	☺ ☺ ☺ ☹
July	☺ ☺ ☺ ☺ ☺ ☹
August	☺ ☺ ☺ ☺ ☺ ☺
September	☺ ☹
Legend: Each ☺ represents 50 000 people.	

[1] Calgary Zoo





Percents

Sometimes frequency is expressed as a percent.

Example 1

Clinton Yould measured the heights of 50 elementary students. He recorded the data in a table.

Heights of Students		
Height (cm)	**Tally**	**Frequency**
80-99	𝍸 III	8
100-119	𝍸 𝍸 𝍸 II	17
120-139	𝍸 𝍸 I	11
140-159	𝍸 𝍸 I	11
160-179	III	3

This column adds up to 50.

Clinton then calculated the percent each frequency is of the whole.

$\frac{8}{50} = \frac{16}{100}$ $= 16\%$

$\frac{17}{50} = \frac{34}{100}$ $= 34\%$

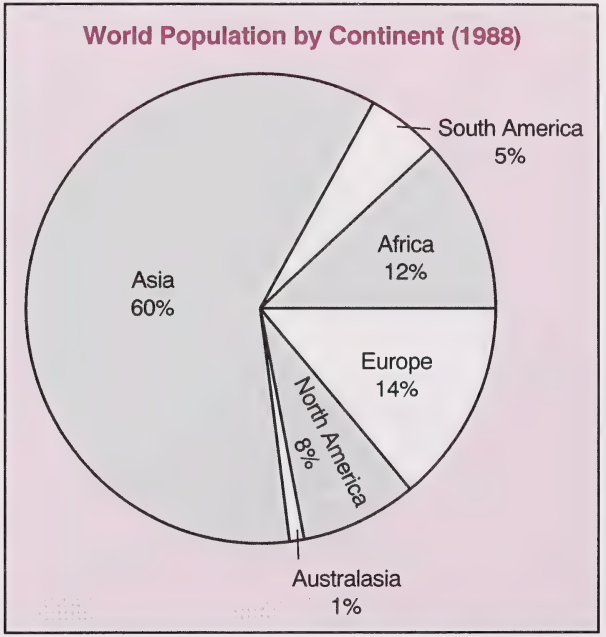
$\frac{11}{50} = \frac{22}{100}$ $= 22\%$

$\frac{3}{50} = \frac{6}{100}$ $= 6\%$

He recorded this information in a table.

Heights of Students	
Height (cm)	**Percent**
80-99	16%
100-119	34%
120-139	22%
140-159	22%
160-179	6%

This column adds up to 100%.



Example 2

Gurtek Poonia researched the population of the world. He displayed the data expressed as percents in a circle graph.

Practice Activity 1

1. Why are tallies a good method of recording data?

2. Use the following classified advertisements to complete a table like the one shown for the kinds of cars advertised.

Racing Cars Advertised		
Kind of Car	**Tally**	**Frequency**
BMW		
Corvette		
Jaguar		
Mercedes		
Mustang		
Nissan		
Porsche		
Other		

Sports, Racing Cars & Parts **980**

1986 CORVETTE, racing red, loaded. 555-3311.

1976 TR6, maroon, all work done, A-one cond. $9 000. 555-1350

1989 NISSAN 240 SX, 5 spd., racing red, only 9 500 km. $17 900. 555-9970.

1989 MUSTANG, 16 valve engine, 5 spd., low km. $17 900. 555-9970.

1973 PORSCHE 911E Targa, one owner, $12 900. 555-8868 or 555-7464.

1987 JAGUAR Sovereign, fully loaded, immaculate cond., 1 owner. Serious enq. only. 555-3808 or 555-7128.

Sports, Racing Cars & Parts **980**

1983 MUSTANG GLX 5.0L, convertible, 4 spd., silver, red interior. Well maint'd. $10 900. 555-2219 evg's.

1981 JAGUAR XJ6, black, 70 000 mi, exc. cond., $19 800 obo. 555-4650.

1977 MGB MARK IV, gold, engine & drive train exc. $2 800 obo. 555-3517.

1971 CORVETTE, 350, LT1, 5 spd., restored, $22 000 obo. 555-0703.

1986 BMW 325E, 2 dr., navy blue, 43 000 kms. $19 000. 555-0311.

1981 PORSCHE TARGA softback. Very rare. Leather, 5 spd., new paint & top. $18 000, obo. 555-4725.

1974 TRIUMPH TR6. Reconditioned. Rust free. $8 900. 555-3634.

1980 MG MIDGET, Excellent condition, $4 250/obo, 555-0765.

1984 MERCEDES 500 SEL Dark gray, immac. $49 900. 555-0612.

1980 PORSCHE 924 Turbo. Air, p.w., glass sunroof, etc. Not winter driven. Exc. cond. Ph. 555-0039.

1980 CAMARO Z28, gold, no rust, T-roof, 350 v8, dual exhaust, headers, Kenwood stereo system, car cover & bra, $5 300. 555-9394.

1984 CORVETTE, only 8 000 mi., very nice, $25 900. 555-3980.

1982 PORSCHE. 30 000 original kms., S. pkg., all leather, alarm, dark blue. $33 333. 555-6743 days/after hrs. 555-9873.

3. Use the table which shows the results of an unofficial poll on a forthcoming election to answer the following questions.

Which Candidate Will You Vote For?		
Candidate	**Tally**	**Frequency**
D. Albrecht	𝍸 𝍸 𝍸 𝍸	118
K. Busenius	𝍸 𝍸 𝍸 𝍸 𝍸	159
M. Stoik	𝍸 𝍸 𝍸	74
Undecided	𝍸 𝍸	18
No answer to question	𝍸	13

a. How many people were polled?

b. How many people replied to the question?

c. What percent of the people who replied said they would vote for D. Albrecht? K. Busenius? M. Stoik? About what percent of the people who replied said they were undecided?

4. Use the graph to answer the following questions.

Number of Passengers at Canada's Busiest Airports (1985)[1]

Toronto	15
Montreal (Dorval)	7
Vancouver	8
Calgary	4
Winnipeg	2

Legend: Each represents 100 000 passengers.

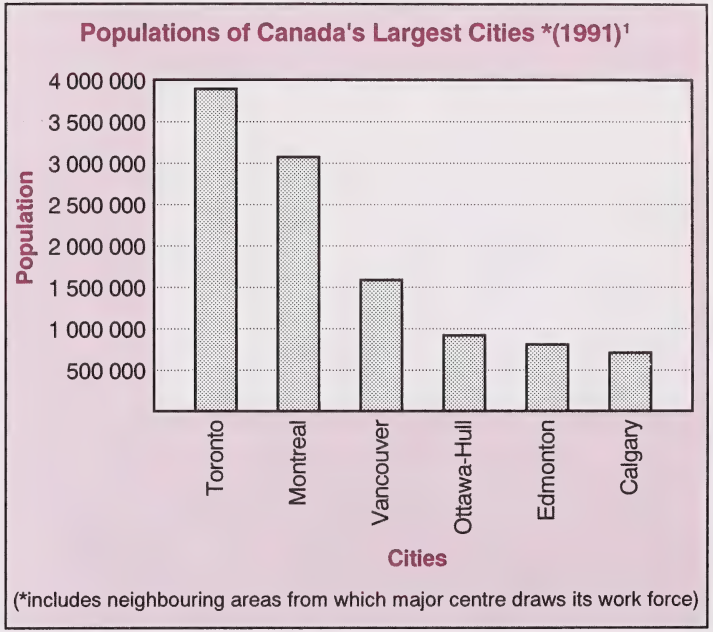
a. Which airport was the busiest in Canada in 1985?

b. Did the Vancouver airport handle more passengers than the Montreal (Dorval) airport in 1985?

c. How many more passengers were handled in Vancouver than in Calgary in 1985?

[1] Statistics Canada

5. Use the graph to answer the following questions.



a. About how many people lived in Calgary in 1991?

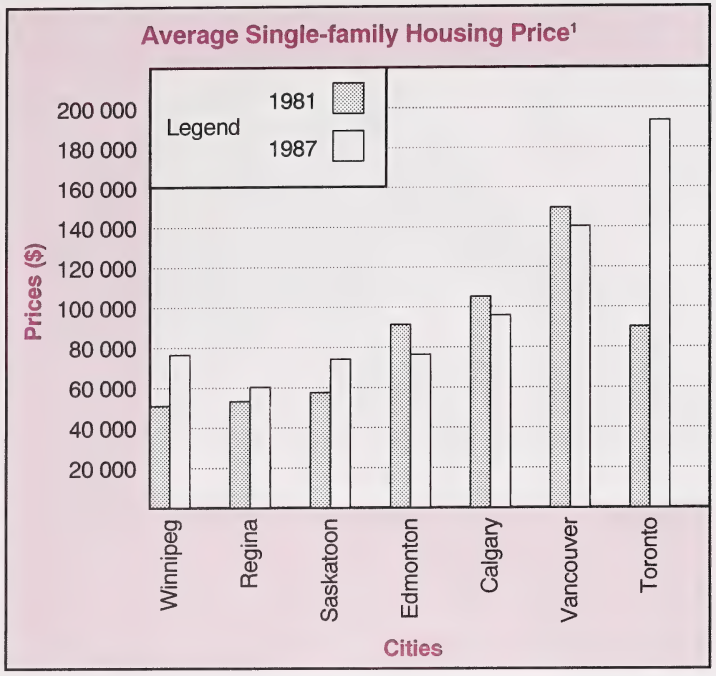
b. About how many people lived in Montreal in 1991?

c. About how many people lived in Vancouver in 1991?

d. About how many more people lived in Toronto than in Calgary in 1991?

[1] Statistics Canada

6. Use the graph to answer the following questions.



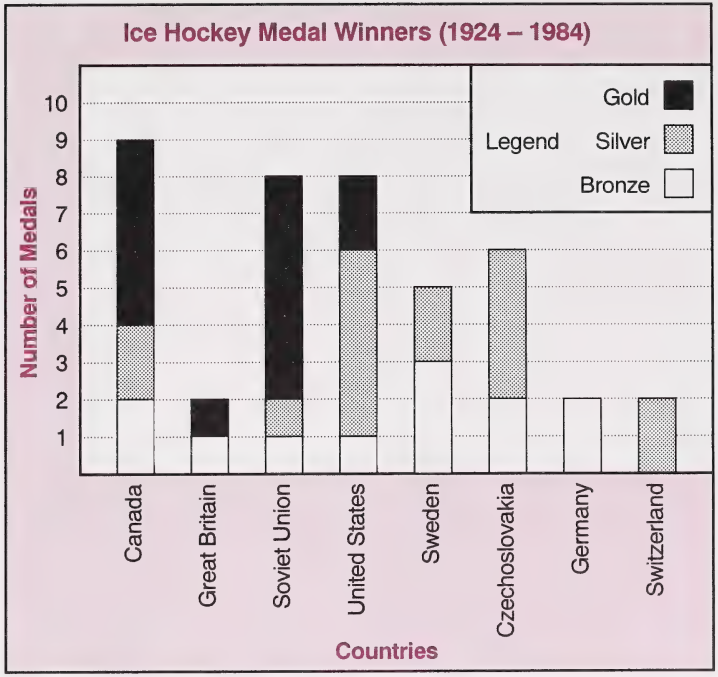
a. In which city did houses cost the most in 1981? In 1987?

b. By how much did house prices decrease in Vancouver between 1981 and 1987?

c. By how much did house prices increase in Toronto between 1981 and 1987?

[1] Statistics Canada

7. Use the graph to answer the following questions.

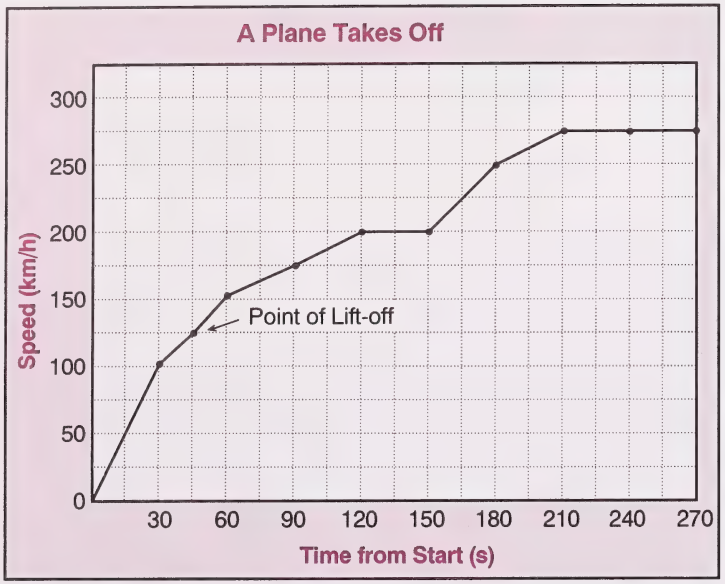


a. Which country won the most ice hockey medals between 1924 and 1984?

b. Which countries won gold medals in ice hockey during the period?

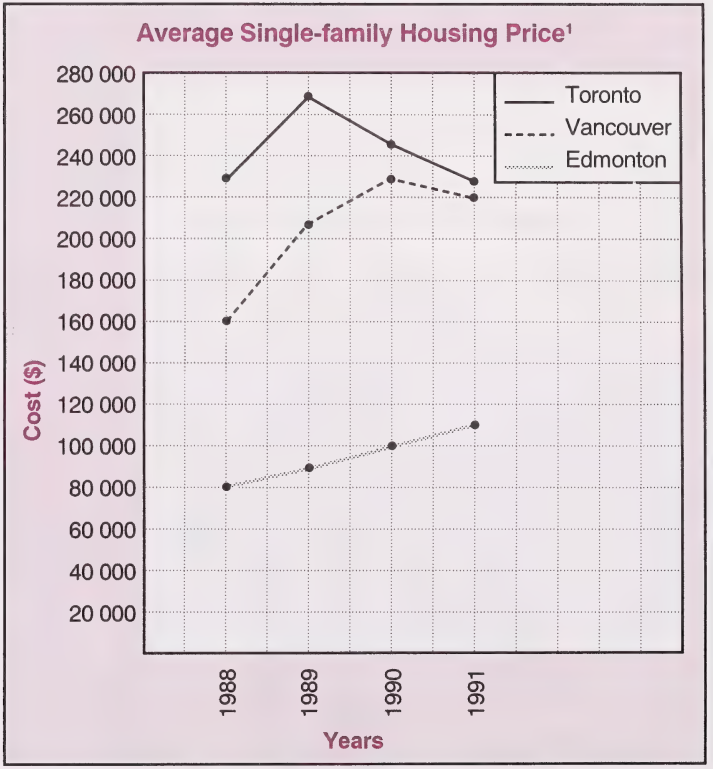
c. How many gold medals in ice hockey did each country win during the period?

8. Use the graph to answer the following questions.



a. When did the plane lift off?
b. How fast was the plane travelling when it lifted off?
c. What was the highest speed attained by the plane?

9. Use the graph to answer the following questions.



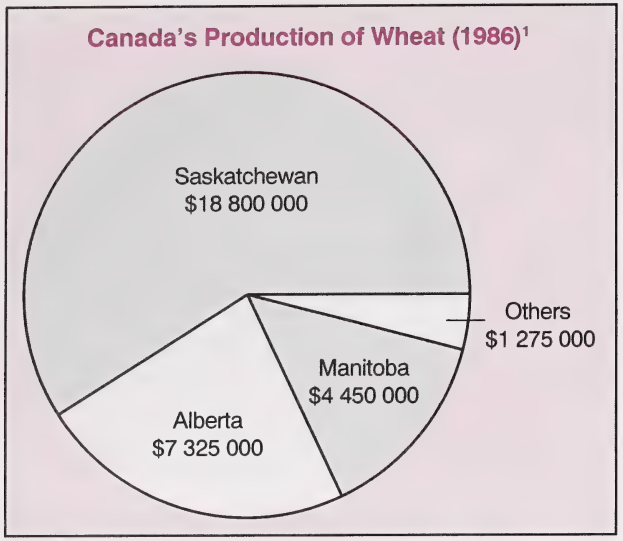
a. In which of these cities did houses cost the most in 1988?

b. In which of these cities did houses cost the least in 1988?

c. In which of these cities did house prices steadily increase between 1988 and 1991?

[1] Statistics Canada

10. Use the graph to answer the following questions.



a. Which province produced the most wheat in 1986?

b. About how many dollars worth of wheat was produced in Canada in 1986?

c. About what percent of the total production of wheat was produced in each province in 1986?

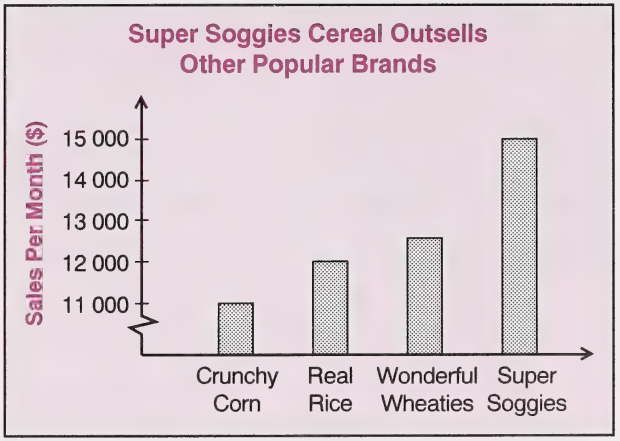
Turn to the Appendix to check your answers.

[1] Statistics Canada

Working Together

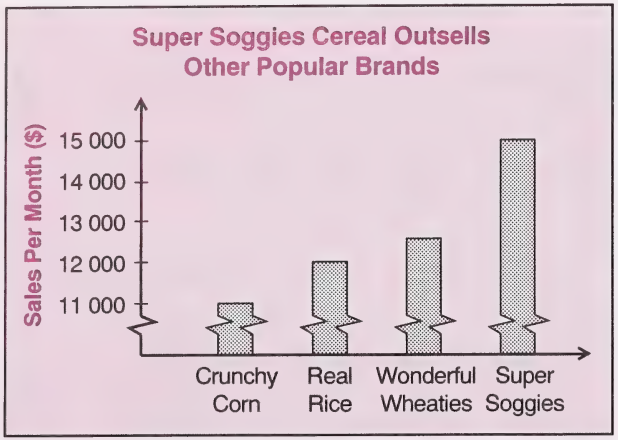
Advertisements try to present data about the sponsor's products in a favourable way. Sometimes advertisers stretch the truth by creating a false impression of the data. Don't believe everything that you read or see – or what you *think* you read or see.

Example 1

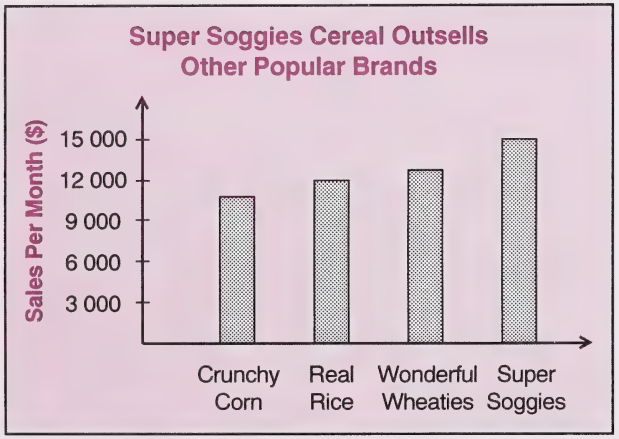


From the graph, it looks as if Super Soggies' sales are double the sales of its nearest competition; the bar for Super Soggies is twice the height of the bar for Wonderful Wheaties. This impression is created by breaking the scale on the vertical axis.

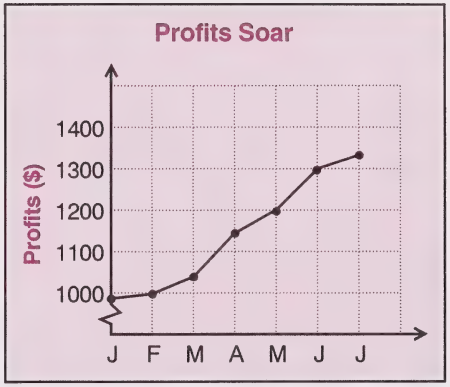
If the scale must be broken because of space constraints, it should be indicated both in the axis and in each bar, as shown in the following graph.



If the scale was not broken, it would look like this.

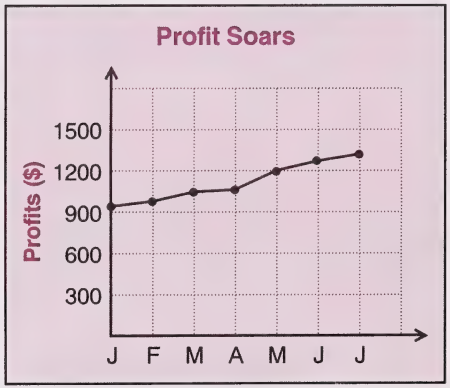


Example 2

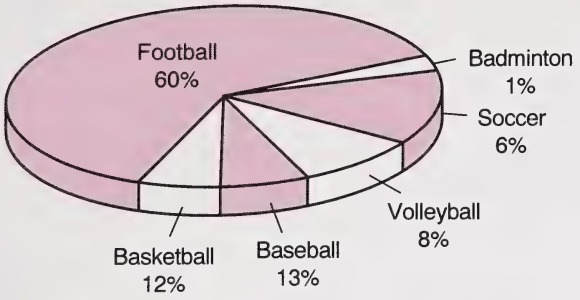


The vertical scale is broken to give the impression that the profits are rising quickly.

If the scale was not broken, the graph would look like this.

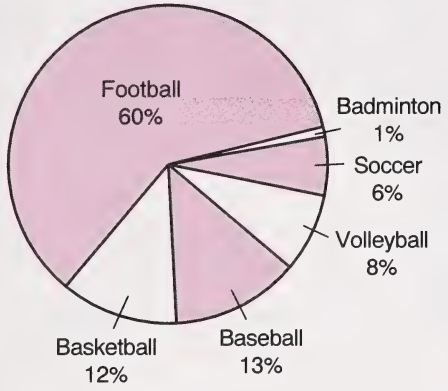


Example 3

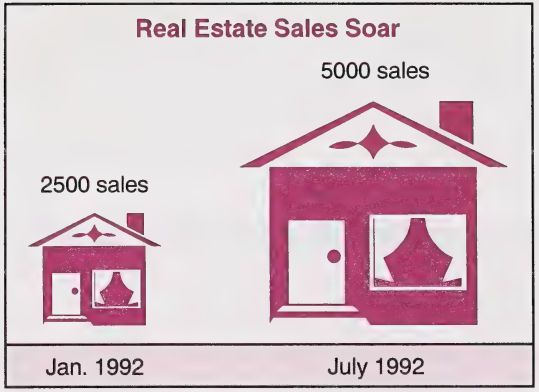


The three-dimensional appearance of this graph is deceiving. It looks as if more of the budget is spent on soccer than on basketball or baseball. This is not the case.

The following graph is more accurate.

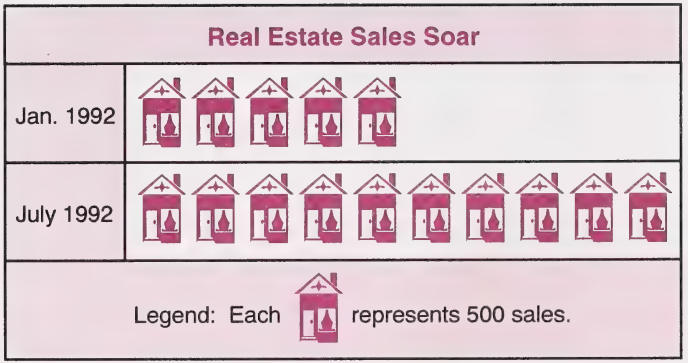


Example 4



This pictograph is misleading because the areas of the pictures are out of proportion to the sales. The sales in July are twice those in January. However, the picture representing the July sales is twice as tall and twice as wide as the picture representing January sales.

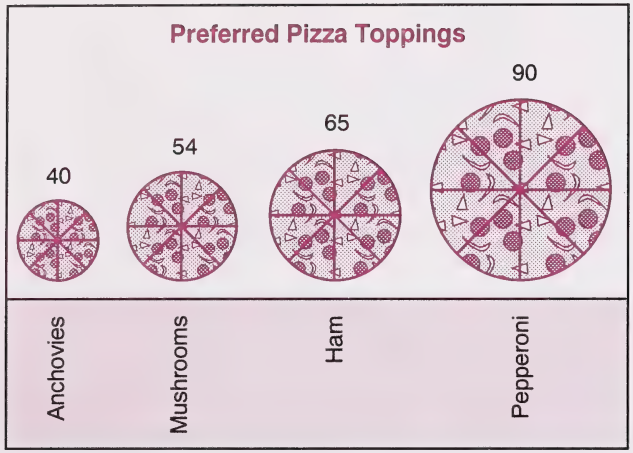
A more realistic graph uses individual pictures which are the same size.



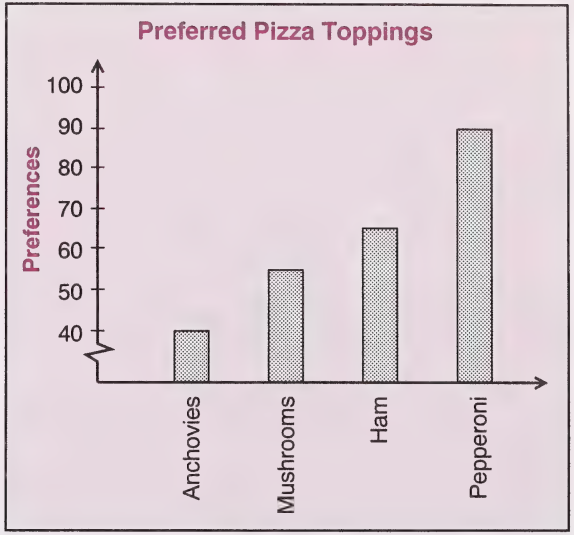
Practice Activity 2

1. Explain why the following graphs are misleading.

a.

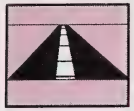


b.



2. Redraw the graphs in Question 1 more realistically.

Turn to the Appendix to check your answers.



What Lies Ahead

In this section you will learn these skills.

- finding the mean, median, and mode
- finding the range
- finding the percentile

Working Together

In the previous section you examined the frequency of events and actions. In this section you will analyse data and describe the data in several ways.

Mean

One way to analyse data is to find the **mean**. The mean is the arithmetic average of a set of values. It is the sum of a set of values divided by the number of values.

Example 1

Sally got scores of 80, 96, 84, 95, and 90 on five games of bowling. What is the mean?

Solution

$$\text{mean} = \frac{\text{sum of scores}}{\text{number of scores}}$$

$$= \frac{80 + 96 + 84 + 95 + 90}{5}$$

$$= \frac{445}{5}$$

$$= 89$$

The mean of Sally's bowling scores is 89.

Example 2

There are 20 students in Mr. Miller's Grade 9 class. This is a list of their ages.

13	14	14	15
14	15	14	15
15	16	15	15
15	14	15	14
14	13	15	13

What is the mean?

Solution

Make a table of the ages and the number of times they occurred.

Ages of Students in Mr. Miller's Grade 9 Class		
Age	**Tally**	**Frequency**
13	III	3
14	𝍸 II	7
15	𝍸 IIII	9
16	I	1

Then calculate the mean.

$$\text{mean} = \frac{\text{sum of ages of students}}{\text{number of students}}$$

$$= \frac{(3\times13)+(7\times14)+(9\times15)+16}{20}$$

$$= \frac{39+98+135+16}{20}$$

$$= \frac{288}{20}$$

$$= 14.4$$

The mean of the ages is 14.4 a.

Median

Another way to analyse data is to find the **median**. The median is the middle number of a set of numbers, or the arithmetic average of the two middle numbers of a set of numbers, when the numbers are listed in order.

Example 1

Maria Parito is a commissioned salesperson. Her income varies from week to week. In five weeks she earned $410, $580, $640, $620, and $520. What is the median of her income?

Solution

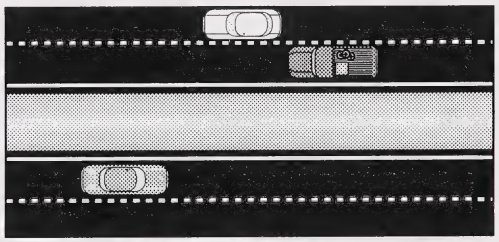
Arrange the numbers in order from least to greatest and find the median.

410 520 **580** 620 640

↑
Median

The median of her weekly income is $580. Half the weekly incomes are below $580 and half are above $580.

Note: To help you recall that median means *middle*, think of the median of a highway.



Example 2

Juanita counted the number of vehicles that passed her house over an eight-hour period.

This is a table of the number of vehicles she counted each hour.

Passing Vehicles	
Time	**Number of Vehicles**
9 a.m.	27
10 a.m.	52
11 a.m.	36
12 noon	95
1 p.m.	27
2 p.m.	18
3 p.m.	42
4 p.m.	118

What is the median of the number of passing cars per hour?

Solution

Arrange the numbers in order from least to greatest and find the median.

18 27 27 **36** **42** 52 95 118

↑
Median

$$\frac{36+42}{2} = \frac{78}{2}$$

$$= 39$$

The median of the number of passing cars per hour is 39. Half the counts are below 39 and half are above 39.

Example 3

Eugene counted the number of people who arrived to work in each vehicle in one working day. He made a list of these numbers.

2	3	4	2	3	2	2
2	2	1	3	2	2	4
2	7	5	2	3	6	1
4	2	1	4	1	1	5
1	3	5	1	2	4	1

What is the median number of people per car?

Solution

Method 1

Arrange the number in order from least to greatest and find the median.

1	1	2	2	3	4	5
1	1	2	2	3	4	5
1	1	2	(2)	3	4	5
1	2	2	2	3	4	6
1	2	2	2	3	4	7

The median is 2 people/car. Half the cars have this number of passengers or less, and half the cars have this number of passengers or more.

Solution

Make a table of the number of people per car and the number of times they occurred. Use the table to find the median.

People Arriving to Work in Each Car		
Number of People per Car	Tally	Frequency
1	𝍸 III	8
2	𝍸 𝍸 II	12
3	𝍸	5
4	𝍸	5
5	III	3
6	I	1
7	I	1

17

←1

17

Median

This column adds up to 35.

The median is 2 people/car. Half the cars have this number of passengers or less. Half the cars have this number of passengers or more.

Mode

Another way to analyse data is to find the **mode**. The mode is the number that occurs the most in a set of numbers. There may be more than one mode.

Example 1

In one hour a shoe store sold seven pairs of shoes. This is a list of the shoe sizes sold.

8 9 9 7 9 11 6

What is the mode?

Solution

Arrange the numbers in order from least to greatest and find the mode.

6 7 8 9 9 9 11

Mode

The mode of the shoe sizes sold is 9.

Example 2

Juan is a soccer goalie. This is a table of the goals scored against him in seven games.

Soccer Results							
Game	1	2	3	4	5	6	7
Goals Scored	3	5	2	5	0	2	4

What is the mode?

Solution

Arrange the numbers in order from least to greatest and find the mode.

0 2 2 3 4 5 5

Mode Mode

There are two modes, 2 and 5.

Example 3

In a gym class 20 students took five free throws each at the basket on a basketball court. The number of successful throws were recorded.

3	4	1	1	5
1	0	5	0	3
3	2	3	3	0
3	3	2	2	4

What is the mode?

Solution

Make a table of the numbers of successful free throws and the number of times they occurred. Use the table to find the mode.

Free Throws in Gym Class	
Successful Free Throws	**Frequency**
0	3
1	3
2	3
3	7
4	2
5	2

Mode → ← Most occurrences

The mode is 3 successful free throws.

Range

Another way to analyse data is to find the **range**. The range is the difference between the greatest and the least value in a distribution.

Example 1

The Crash Bang Wallopers are the city champions in floor hockey. During the play-offs they played nine games. They scored the following numbers of goals.

14	6	8	7	4	6	7	5	1

What is the range?

Solution

The greatest score is 14. The least score is 1.

$14 - 1 = 13$

The range is 13 goals.

Example 2

This is a list of the science marks of 75 Grade 9 students.

82	52	62	95	40	50
65	75	58	67	81	42
46	63	72	53	76	55
39	60	70	59	58	64
73	85	45	72	62	73
38	78	80	62	66	61
69	56	61	56	51	57
90	53	66	72	43	59
56	65	47	63	92	87
80	78	55	84	63	62
59	65	57	63	62	
56	62	67	61	50	
70	58	72	60	53	

What is the range of the scores?

Solution

The greatest score is 95. The least score is 38.

$95 - 38 = 63$

The range is 63.

The Effect of Range

The range can affect your choice of mean, median, and mode to describe data.

Example

The table shows the amount earned in one week by five salespeople.

Earnings in One Week	
Salesperson	**Earnings ($)**
Joe	435
Jon	410
Kim	415
Andrew	425
Kelly	950

What is the mean?

Solution

$$\text{mean} = \frac{435 + 410 + 415 + 425 + 950}{5}$$

$$= 527$$

The mean is $527.

Notice that the earnings of the first four salespeople are clustered between $410 and $435. The earnings of the fifth salesperson, Kelly, differ widely from the others; Kelly's earnings are about twice each of the others. This has the effect of raising the mean.

The median is more representative.

410 415 **425** 435 950

The median of the earnings is $425.

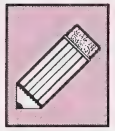
Another way to describe the data is to round all the numbers and find the mode.

410 415 425 435 950 400 400 400 400 1000

Mode

The mode of the earnings is about $400 per week.

Practice Activity 1



Print Alternative

1. In the west end of a city there is a "gas war" as filling stations compete to sell gas to the motorists. The nine gas stations are offering to sell gas at the following prices per litre.

43.9	39.9	37.9	40.9	39.9	39.9	38.9	44.9	41.9

a. Find the mean of the prices.
b. Find the median of the prices.
c. Find the mode of the prices.
d. Find the range of the prices.

2. The salaries paid to the management of a certain business are shown in the following chart.

Position	Yearly Salary ($)
President	150 000
Vice-president	100 000
Controller	85 000
Plant Manager	53 000
Accountant	48 000
Personnel Administrator	40 000
Research Director	40 000
Public Relations Director	40 000

a. Find the mean.

b. Find the median.

c. Find the mode.

d. Find the range.

e. Which description of the data do you think is most representative? Why?

3. A student dentist visited the Grade 1 class at Trudeau Elementary School and checked their teeth to see how many fillings are needed. The findings are shown in this list.

0	1	1	0	0	1	3	2	2	0	1	1	2
0	0	0	0	5	1	0	0	0	3	0	4	2

a. Find the mean.
b. Find the median.
c. Find the mode.
d. Find the range.

Computer Alternative

4. Do Program 1, "The Three Ms", on Disk A of *Mathematics Activities Courseware* 8 (Houghton-Mifflin).

Turn to the Appendix to check your answers.

Working Together

Percentile

People are often interested in comparing data.

Example 1

Raphael is 3 years old. He lives in an apartment building.

This is a list of the residents' ages ordered from greatest to least.

93	53	38	24	14
90	52	38	24	14
89	50	38	23	12
87	49	38	23	12
82	48	37	23	10
82	48	37	22	10
73	47	36	21	10
70	47	36	21	9
68	46	36	20	9
67	46	34	19	8
67	46	34	17	7
66	46	32	17	5
65	44	32	17	5
64	43	32	16	4
63	42	30	16	(3)
62	42	29	15	2
61	41	29	15	2
59	41	28	15	2
58	40	27	14	2
57	40	26	14	1

How does Raphael's age compare to ages of the other residents?

Solution

One way to compare Raphael's age to the others is to divide the list of ages in half.

93	53	38	24	14
90	52	38	24	14
89	50	38	23	12
87	49	38	23	12
82	48	37	23	10
82	48	37	22	10
73	47	36	21	10
70	47	36	21	9
68	46	36	20	9
67	46	34	19	8
67	46	34	17	7
66	46	32	17	5
65	44	32	17	5
64	43	32	16	4
63	42	30	16	(3)
62	42	29	15	2
61	41	29	15	2
59	41	28	15	2
58	40	27	14	2
57	40	26	14	1

Raphael's age is in the lower half of the list.

Another way to compare Raphael's age is to divide the list of ages into quarters.

93	53	38	24	14
90	52	38	24	14
89	50	38	23	12
87	49	38	23	12
82	48	37	23	10
82	48	37	22	10
73	47	36	21	10
70	47	36	21	9
68	46	36	20	9
67	46	34	19	8
67	46	34	17	7
66	46	32	17	5
65	44	32	17	5
64	43	32	16	4
63	42	30	16	(3)
62	42	29	15	2
61	41	29	15	2
59	41	28	15	2
58	40	27	14	2
57	40	26	14	1

Raphael is is in the lower quarter of the list.

Another way to compare Raphael's age to the others is to count his position. Raphael's age is 95th in the list. He is older than 5 out of 100 residents. This rank can be expressed as a percentile. Raphael's age is in the 95th percentile.

Example 2

Daina scored 84 on an English test.

This is a list of the marks. They are ordered from greatest to least.

95	79	71	63
92	78	69	58
91	78	68	58
(84)	75	65	56
80	74	63	53

How does this score compare to her classmates' marks on the test?

Solution

One way to compare Daina's score is to divide the set of marks in half.

95	79	71	63
92	78	69	58
91	78	68	58
(84)	75	65	56
80	74	63	53

Daina scored in the upper half of her class.

Another way to compare Daina's score is to divide the set of marks into quarters.

95	79	71	63
92	78	69	58
91	78	68	58
(84)	75	65	56
80	74	63	53

Daina scored in the upper quarter of her class.

Another way to compare Daina's score is to count her position. Daina scored fourth. She did better than 16 out of 20 students. This ranking can be expressed as a percentile.

$$\frac{16}{20} = \frac{80}{100}$$

Daina scored in the 80th percentile. She did better than 80% of the students.

Example 3

Ramona received the results from her biology test.

- Percent: 83%
- Percentile: 95

What does this information mean?

Solution

- Percent: 83%

  This means that Ramona correctly answered most of the questions on the test. She received 83 marks out of 100 marks.

- Percentile: 95

  This means that Ramona ranked higher than 95% of the students. In other words, she did better than 95 out of 100 students taking the test.

Example 4

André was told that his performance in the long jump placed him in the 76th percentile of competing athletes. What was André's rank if 125 athletes competed?

Solution

$$76\% \text{ of } 125 = 0.76 \times 125$$
$$= 95$$

André performed better than 95 out of 125 students.

$$125 - 95 = 30$$

André ranked 30th out of 125 in the event.

Practice Activity 2

1. Mr. McCarthy asked 100 students, "How many brothers and sisters do you have?" The results are listed in order from greatest to least in the following table.

(8)	4	3	2	1	1	1
7	4	3	2	1	1	1
6	4	3	1	1	1	1
6	4	2	1	1	1	1
6	4	2	1	1	1	0
6	3	2	1	1	1	0
6	3	2	1	1	1	0
6	3	2	1	1	1	0
6	3	2	1	1	1	0
(5)	3	2	1	1	1	0
4	3	2	1	1	1	
4	3	2	1	1	1	
4	3	2	1	1	1	
4	3	2	1	1	1	
4	3	2	1	1	1	

   a. Jeanna has 8 brothers and sisters. Calculate her percentile ranking.

   b. Norman has 5 brothers and sisters. Calculate his percentile ranking.

2. Thelma measured the depth of the stream near her house for the first 25 days in September.

   The measurements are listed in order from greatest to least.

63	58	55	(53)	50
62	57	55	52	50
60	57	54	51	50
60	57	54	51	50
(59)	57	54	51	50

   a. On September 12, the stream was 59 cm deep. Calculate the percentile ranking.

   b. On September 25, the stream was 53 cm deep. Calculate the percentile ranking.

3. Gina scored 73% in a recent national mathematics contest and was in the 80th percentile.

   a. Which of these numbers compares her performance?
   b. Which of these numbers describes her performance?

4. Fifty students competed in a golf tournament

   a. Andrea finished 17th. Find her percentile ranking.
   b. What is Carla's ranking if she scored in the 60th percentile?

Turn to the Appendix to check your answers.

What Lies Ahead

In this section you will use these skills.

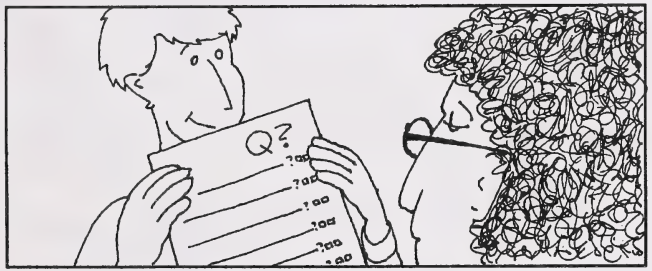
- interpreting a census
- interpreting a sample
- estimating properties of a population from sample results

Working Together

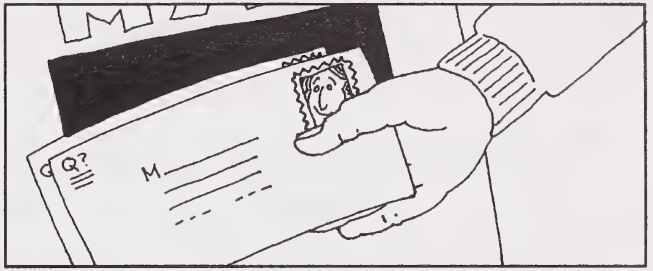
Everyone collects data daily by reading, listening, and observing.

Data can also be gathered by doing surveys. Surveys can be conducted in several ways.

- handing out questionnaires

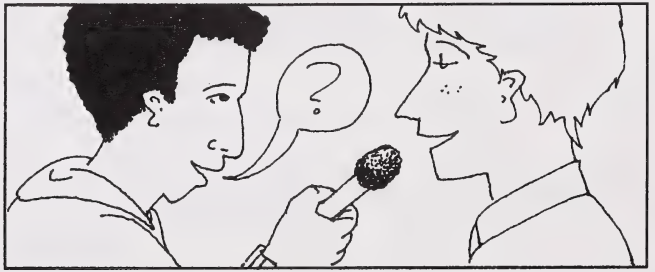


- mailing out questionnaires



- conducting telephone interviews

- conducting personal interviews



The total number or quantity of individuals or items about which information is collected is called a **population**.

The method used to count or measure the property of an entire population is a **census**.

The method used to count or measure the property of a representative group of the entire population is a **sample**.

Censuses

There are different ways to carry out a census to investigate a property of the population.

Example 1

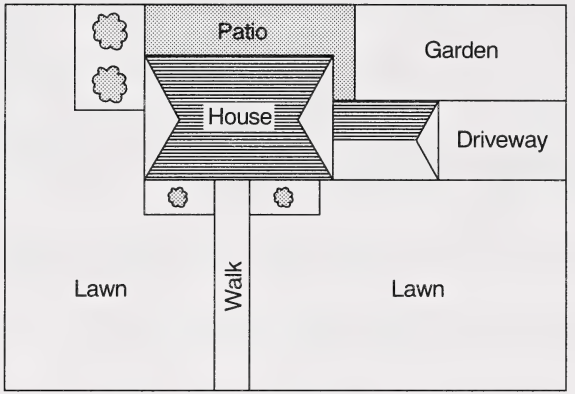
Regan, the president of the student council at Northwood Junior High, must decide which colour to order for the school jackets – garnet, gold, or white. There are 320 students at Northwood High, and Regan wants to know their opinion before choosing the colour.

What property of the population does Regan want to research? The property of the students about which Regan wants data is their colour preference for school jackets.

How can Regan conduct a census to gather this data? She can obtain a list of the students' names from the principal and interview each student or have them complete a questionnaire.

Example 2

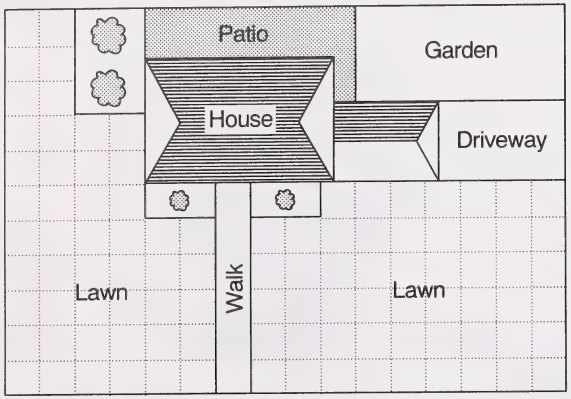
Stephen wonders if he should spray his lawn for weeds. To make his decision, he needs to know what kinds of weeds are in his lawn and how many there are.



What property of the weeds in his lawn does Stephen want to research? He wants to know the kinds and numbers of weeds.

How can Stephen conduct a census to gather the data? He can identify and count each weed in the lawn. However, it may be difficult to keep track of which weeds have been counted.

To ease the process, Stephen can use string and posts to divide the lawn into 100 squares.



Stephen can identify and count the weeds in each square and then total these counts to make his decision.

Example 3

Martha is involved in an accident at an uncontrolled intersection. She believes the intersection is dangerous and there should be a traffic light. To test her belief, she needs to gather information about the number of traffic accidents at the intersection during the last ten years.

What property of the population does Martha want to research? She wants to know the number of traffic accidents at the intersection during the last ten years.

How can Martha conduct the research? The police in her town keep records of the traffic accidents that have happened there. Martha could research the records to see how many accidents occurred at the specific intersection in the last ten years.

Practice Activity 1

For each of the following questions, name the population and the property of the population that is being counted or measured. Then explain how a census could be conducted.

1. Mia wants to know how many of the children at the elementary school in her town go to school without eating breakfast.

2. Ralph wants to know how many earthworms there are in his garden.

3. Research the census of Canadians that is held every five years.

   a. How is it conducted?

   b. How much money does a census cost?

   c. Why is the census necessary? What is done with the data that are obtained?

   d. Is the census 100% accurate? Why or why not?

Turn to the Appendix to check your answers.

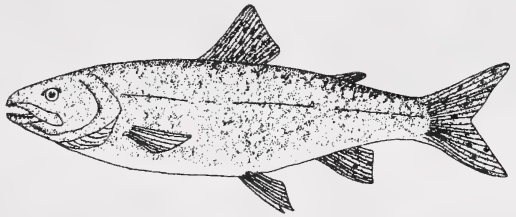
Working Together

Problems With Censuses

Sometimes it is very difficult or impractical to carry out a census.

Example 1

Clinton wants to know the length of the trout in Carson Lake.



What property of the population does Clinton want to research? He wants to know the length of the trout.

How can he conduct a census to gather the data? Clinton would have to try to net every trout in Carson Lake and measure it. This would be very difficult to do.

The fish could not be kept out of water too long or they would die.

Even if Clinton tags the dorsal fin of each trout and then releases it, he could not be certain he had captured and measured every fish.

Example 2

Louise wants to know how far the roofs of the cars produced at her automobile factory collapse when they roll in an accident.

What property of the population does Louise want to research? She wants to know the distance the roof collapses when the car rolls.

How can she conduct a census to gather the data? She can do a test by rolling each car and measuring how far the roof collapses. However, this would damage or destroy all the cars so they could not be sold.

Sampling

In statistics, a **sample** is commonly used to estimate a property of the population, rather than conducting a census. A sample is a part of the population. You have been using a sample to make conclusions about populations for years, although you may not have realized it.

- When you open a few pods of peas in your garden to see if the crop is ready to harvest, you are sampling.
- When you taste a spoonful of soup to determine if the soup has enough seasoning, you are sampling.
- When you watch a television program for a few minutes to decide if you should change the channel or continue viewing, you are sampling.
- When you are ill and your doctor takes a vial of your blood and tests it to see if your white blood count is elevated, this is a sample.

Video Activity

You may wish to watch the video *MATHWORKS: Sampling* or *SOLVE IT: Sampling* to learn about how a sample is chosen.

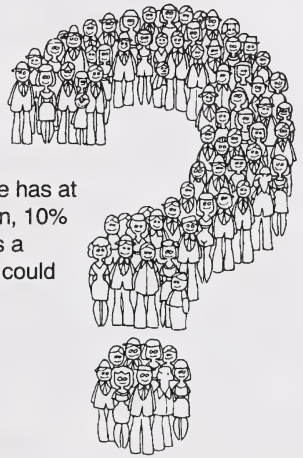
Choosing an Unbiased Sample

In order to make conclusions about a population from a sample, the sample must be representative of the whole population. That is, the sample should have the same properties as the population.

When taking a sample, you should be sure that the sample is selected without bias. Any special interest which causes a researcher to prefer one sample to another is **bias**. Bias prevents sampling from being trustworthy.

Bias can be eliminated from the sampling procedure by selecting the members of the sample in a random way. For example, the members of a population are assigned a number and the numbers are put in a hat. Then the hat is shaken and a number is drawn. This method gives every member in the population an equal chance of being chosen. The sample is called a **random sample**.

Choosing a Large Enough Sample



In order to make conclusions about a population based on a sample, the sample must be large enough. There are no specific rules, but usually a sample has at least 30 members. For a small population, 10% of the population is sometimes chosen as a sample. For a very large population, 3% could be chosen.

Practice Activity 2

For each of the following, explain why the sample is biased.

1. Interviews were conducted with people randomly leaving and entering a swimming pool to determine how many people in the community can swim.

2. A questionnaire was handed out to students randomly selected from Hillcrest Junior High School to measure the popularity of a new video game among the teenagers in the community.

3. A telephone poll was conducted by telephoning people whose numbers were randomly chosen from the Calgary telephone book to determine the number of unemployed workers in Calgary.

4. A newspaper printed a survey form and counted the responses that were returned to determine their readership's attitude to capital punishment.

5. The population of bighorn sheep in Alberta was estimated by dividing the province into sections of 1 km^2 and then randomly selecting 500 of these sections to form a sample.

6. At a dinner party the hostess asked every second guest at the table their preference of after-dinner activities.

Turn to the Appendix to check your answers.

Working Together

Now that you understand how to select a random sample, you are ready to use samples to estimate the population.

Example 1

Do you recall the problem in which Regan wants to discover the colour preferences of the 320 students at Northwood Junior High so she can order school jackets?

If Regan interviewed a random sample of 32 students and discovered that 18 prefer garnet, 10 prefer white, and 4 prefer gold, estimate the number in the population who will prefer garnet.

Solution

Because the sample is representative of the population, the preference will be proportional. In other words, the ratio of students who prefer garnet to the total number of students will be about the same.

$$\frac{\text{Prefer garnet}}{\text{Total}}$$

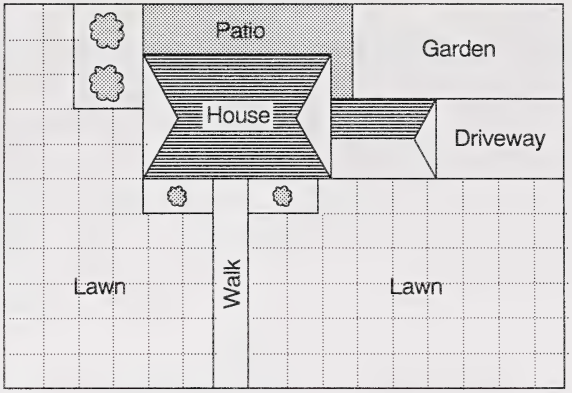
$$\frac{18}{32} \doteq \frac{n}{320}$$

$$5760 \doteq 32n$$

$$180 \doteq n$$

So, about 180 students will prefer garnet.

Example 2



Do you recall the problem in which Stephen wants to find the kinds and numbers of weeds in the population?

If Stephen identified and counted the weeds in 30 randomly-selected squares on his lawn and discovered that there were only 12 dandelions and 6 broad-leaf plantain in the sample, estimate the number of each type of weed in the total population.

Solution

The sample is representative of the population, so the kinds and numbers of weeds will be proportional.

$$\frac{\text{Dandelions}}{\text{Total}}$$

$$\frac{12}{30} \doteq \frac{n}{100}$$

$$1200 \doteq 30n$$

$$40 \doteq n$$

There are about 40 dandelions in his lawn.

Broad-leaf plantain / Total

$$\frac{6}{30} \doteq \frac{n}{100}$$
$$600 \doteq 30n$$
$$20 \doteq n$$

There are about 20 broad-leaf plantain in his lawn.

Example 3

The Fish and Wildlife Department uses the **capture-recapture** method to estimate the size of some wildlife populations.

In order to estimate the trout population in a lake in a provincial park, the wildlife officers randomly catch a sample of 200 trout with a net.

The wildlife officers put a plastic tag around the dorsal fin of each fish in the sample and then release the trout in the lake.

One week later the wildlife officers return and randomly net a second sample of 250 trout in the same lake. They find that 40 of these were caught the week before and release all the fish again.

The wildlife officers use a proportion to estimate the total number of trout in the lake.

In the catch / In the lake

Number of tagged trout / Total number of trout

$$\frac{40}{250} \doteq \frac{200}{n}$$
$$40n \doteq 50\,000$$
$$n \doteq 1250$$

There are about 1250 trout in the lake.

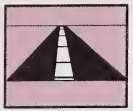
Practice Activity 3

1. Sarah Wurz picked 15 potatoes from 3 hills chosen at random on her farm. How many potatoes will there be in 60 hills?

2. Jackson randomly asks 2 people in a community of 832 if they can swim. He reports that 50% of the community can swim. Is this accurate? Why or why not?

3. Randy checks a random sample of 25 tires in every batch of 1000. If 2 tires in the sample are defective, how many in the whole batch are likely to be defective?

Turn to the Appendix to check your answers.



What Lies Ahead

In this section you will learn these skills.

- interpreting probability
- using data from past records, samples, experiments, and simulations to predict the probability of future events occurring
- using a formula to predict the probability of future events

Working Together

Probability is a number that shows how good a chance there is that a future event will occur.

The probability of a future event occurring is between 0 and 1 or between 0% and 100%.

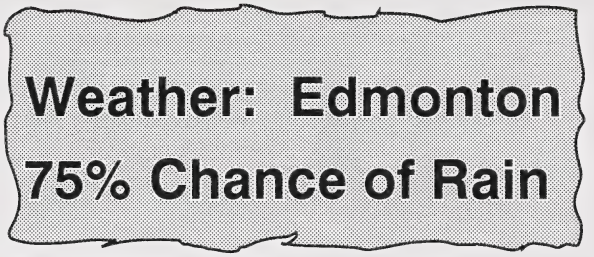
When it is impossible for a future event to occur, the probability of the event occurring is 0 or 0%.

When the future event is certain to occur, the probability of the event occurring is 1 or 100%.

When a future event is very unlikely to occur, the probability of the event occurring will be closer to 0 than 1 or closer to 0% than 100%.

When a future event is very likely to occur, the probability of the event will be closer to 0 than 1 or closer to 100% than 0%.

Example



This headline indicates that the probability of rain in Edmonton is high.

Past records, samples, experiments, and simulations can be helpful for predicting the probability of future events.

Example 1

February 2 is Groundhog Day. There is a legend that says if February 2 is sunny, the groundhog will see his shadow and be frightened back into hibernation and winter will last for six more weeks. If February 2 is cloudy, the groundhog will not see his shadow and there will be an early spring.

Records for a particular town show that is has been sunny on February 2 in 17 out of the past 50 years. What is the probability that it will be sunny there on February 2 next year?

Solution

$$P(\text{sunny}) = \frac{17}{50}$$

This means the probability it will be sunny.

Based on past records, the probability that it will be sunny in the town on Groundhog Day is $\frac{17}{50}$.

Note: Probability can also be expressed as a decimal number or a percent.

$$P(\text{sunny}) = \frac{17}{50} \quad \text{or} \quad P(\text{sunny}) = \frac{17}{50}$$
$$= \frac{34}{100} \qquad\qquad = \frac{34}{100}$$
$$= 0.34 \qquad\qquad = 34\%$$

Based on past records, the probability that it will be sunny in the town on Groundhog Day is 0.34 or 34%.

Example 2

Ruth wrote the numbers from 1 to 4 on a piece of paper like this.

She then asked 20 people chosen at random to pick one of the numbers.

The results of her survey are shown in the following chart.

Pick a Number		
Number Selected	**Tally**	**Frequency**
1	II	2
2	I	1
3	𝍸 𝍸 𝍸 I	16
4	I	1

This column adds up to 20.

Ruth calculated the probability of selecting each number.

$$P(1) = \frac{2}{20} \quad \text{or} \quad P(1) = \frac{2}{20} \quad \text{or} \quad P(1) = \frac{2}{20}$$
$$= \frac{1}{10} \qquad\qquad = \frac{1}{10} \qquad\qquad = \frac{1}{10}$$
$$= 0.1 \qquad\qquad = 10\%$$

Based on the survey, the probability of selecting 1 is $\frac{1}{10}$, 0.1, or 10%.

$$P(2) = \frac{1}{20} \quad \text{or} \quad P(2) = \frac{1}{20} \quad \text{or} \quad P(2) = \frac{1}{20}$$
$$= 0.05 \qquad\qquad = 0.05$$
$$= 5\%$$

Based on the survey, the probability of selecting 2 is $\frac{1}{20}$, 0.05, or 5%.

$$P(3) = \frac{16}{20} \quad \text{or} \quad P(3) = \frac{16}{20} \quad \text{or} \quad P(3) = \frac{16}{20}$$
$$= \frac{4}{5} \qquad = \frac{80}{100} \qquad = \frac{80}{100}$$
$$= 0.8 \qquad = 80\%$$

Based on the survey, the probability of selecting 3 is $\frac{4}{5}$, 0.8, or 80%.

$$P(4) = \frac{1}{20} \quad \text{or} \quad P(4) = \frac{1}{20} \quad \text{or} \quad P(4) = \frac{1}{20}$$
$$= 0.05 \qquad = 0.05$$
$$= 5\%$$

Based on the survey, the probability of selecting 4 is $\frac{1}{20}$, 0.05, or 5%.

Note: The probability of selecting 4 is $\frac{1}{20}$. This does not promise that if Ruth surveys 20 more people, one of them will pick 4 and the other 19 people will pick one of the other numbers. Probability theory does promise that if Ruth does this experiment many times, $\frac{1}{20}$ of the time people will pick 4.

Note: Probability can be expressed as a fraction, decimal number, or percent. The percent form is most useful when comparing probabilities.

$80\% > 10\%$ and $80\% > 5\%$

So, the probability of selecting 3 is greater than the probability of selecting one of the other numbers.

Example 3

Jeff wanted to know the probability of randomly selecting a vowel in the SCRABBLE® Crossword Game.

Jeff randomly selected a tile from the bag of tiles and then replaced the tiles. He repeated the experiment 25 times and tallied the results.

Randomly Selected Tiles		
Tile	**Tally**	**Frequency**
Vowel	𝍸 | | |	8
Consonant	𝍸 𝍸 𝍸 | |	17

This column adds up to 25.

Jeff calculated the probability of selecting a vowel.

$$P(vowel) = \frac{8}{25} \quad \text{or} \quad P(vowel) = \frac{8}{25} \quad \text{or} \quad P(vowel) = \frac{8}{25}$$
$$= \frac{32}{100} \qquad = \frac{32}{100}$$
$$= 0.32 \qquad = 32\%$$

Based on the experiment, the probability of randomly selecting a vowel is $\frac{8}{25}$, 0.32, or 32%.

Example 4

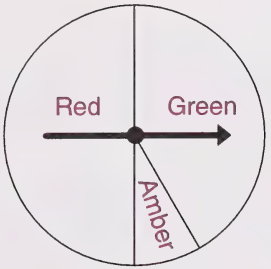
Mark wanted to know the probability of a particular traffic light being a certain colour when a car approached it.

He knew that in every minute, or 60 s, the traffic light is red for 30 s, green for 25 s, and amber for 5 s.

In 6 min, or 360 s, the traffic light is red for 180 s, green for 150 s, and amber for 30 s.

Mark decided to simulate the situation by using a spinner.

He let 1° = 1 s.



Mark twirled the spinner 30 times and recorded the results.

Traffic Light Simulation		
Colour	**Tally**	**Frequency**
Red	𝍸 𝍸 𝍸	15
Green	𝍸 𝍸 ||	12
Amber	|||	3

$$P(red) = \frac{15}{30} = \frac{1}{2}$$ or $$P(red) = \frac{15}{30} = \frac{1}{2} = 0.5$$ or $$P(red) = \frac{15}{30} = \frac{1}{2} = 50\%$$

Based on the simulation, the probability of the light being red is $\frac{1}{2}$, 0.5, or 50%.

$$P(green) = \frac{12}{30} = \frac{2}{5}$$ or $$P(green) = \frac{12}{30} = \frac{4}{10} = 0.4$$ or $$P(green) = \frac{12}{30} = 0.4 = 40\%$$

Based on the simulation, the probability of the light being green is $\frac{2}{5}$, 0.4, or 40%.

$$P(amber) = \frac{3}{30} = \frac{1}{10}$$ or $$P(amber) = \frac{3}{30} = \frac{1}{10} = 0.1$$ or $$P(amber) = \frac{3}{30} = \frac{1}{10} = 10\%$$

Based on the simulation, the probability of the light being orange is $\frac{1}{10}$, 0.1, or 10%.

Practice Activity 1

1. A basketball player has made 33 of the last 50 free throws attempted. Using his past record, what is the probability that the player will make the next free throw?

2. Use the net from the Appendix to construct a regular tetrahedron. What is the probability that the regular tetrahedron will land with the 4 face down if the numbers on the faces are as follows?

   a. 2, 4, 6, 8
   b. 1, 4, 4, 7

3. What is the probability that a person's birth month is January?
   Hint: Make a spinner with the circle from the Appendix to simulate this situation and calculate the probability.

4. Records show that there were 13 057 accidental deaths in Canada in 1990. Of these deaths, 3798 were caused by motor vehicle accidents.[1] Using these past records, what is the probability that an accidental death in Canada is caused by a motor vehicle accident?

5. Raphael surveyed 50 families to discover what home electronic equipment they owned. The results are shown in the following table.

Families with Home Electronic Equipment		
Type	**Tally**	**Frequency**
Audiocassette Player	𝍸𝍸	40
Video Camera	𝍸	5
Compact Disc Player	𝍸𝍸 I	16
Radio	𝍸𝍸 𝍸𝍸 IIII	49
Television	𝍸𝍸 𝍸𝍸 III	48
Videocassette Player	𝍸𝍸 𝍸𝍸	40

Based on this survey, what is the probability that a family will have a videocassette player?

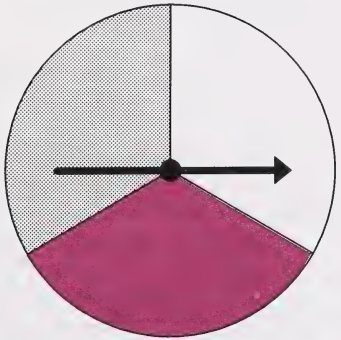
Turn to the Appendix to check your answers.

[1] Statistics Canada

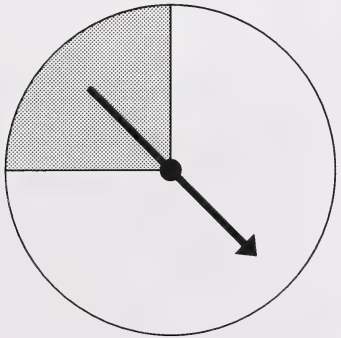
Working Together

An **outcome** is the result of an action like twirling a spinner.

When you twirl this spinner, there are three possible outcomes if you do not include landing on a line: red, grey, and white. The outcomes are **equally likely** to occur.

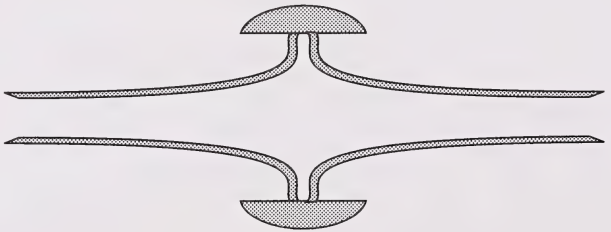


When you twirl this spinner, there are two possible outcomes if you do not include landing on a line: grey and white. The outcomes are **not** equally likely to occur. The area of the white region is much greater than the area of the grey region. So, the chance of white occurring is greater.



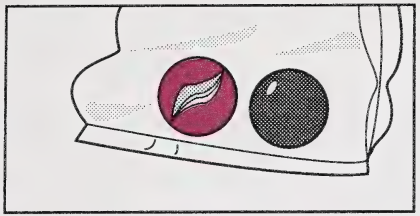
When you toss a coin, there are two possible outcomes: heads and tails. The outcomes are equally likely to occur.

When you toss a paper fastener, there are two possible outcomes: top up and top down. The top is heavier than the bottom, so there is a greater chance of the fastener landing with the top down. The outcomes are **not** equally likely to occur.



Generally, when the possible outcomes of an action are equally likely to occur, the probability of a particular event is the number of favourable outcomes divided by the total number of possible outcomes.

Example 1



There is a black marble and a red marble in a bag. The marbles are identical except for colour. If you pick a marble without looking, what is the probability that the marble will be black? What is the probability that it will be red?

Solution

List the possible outcomes. Let the black marble be B and the red marble be R.

B
R

The marbles are identical except for colour and the draw is made without looking. So, the possible outcomes are equally likely to occur, and the formula can be used.

$$P(black) = \frac{1}{2}$$

Read as "the probability of black occurring".

$$\frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

So, the probability of picking a black marble is $\frac{1}{2}$.

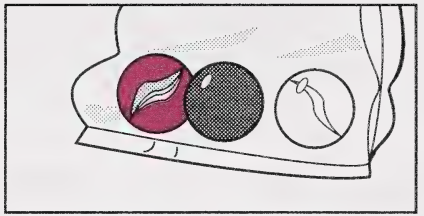
$$P(red) = \frac{1}{2}$$

$$\frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

So, the probability of picking a red marble is $\frac{1}{2}$.

Note: You can say that the probability of picking a red marble is $\frac{1}{2}$, 0.5, or 50%. You say that the probability of picking a black marble is $\frac{1}{2}$, 0.5, or 50%.

Example 2



There are three marbles in a bag: one red, one black, and one white. The marbles are identical except for colour. If you pick one marble without looking, what is the probability that it will be red? What is the probability that it will be black? What is the probability that it will be white?

Solution

List the possible outcomes. Let the red marble be R, the black marble be B, and the white marble be W.

R
B
W

The marbles are identical except for colour and the draw is made without looking. So, the possible outcomes are equally likely to occur, and the formula can be used.

$$P(red) = \frac{1}{3} \quad \text{or} \quad P(red) = \frac{1}{3} \quad \text{or} \quad P(red) = \frac{1}{3}$$
$$= 0.\dot{3} \qquad = 33\frac{1}{3}\%$$

The probability of picking a red marble is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

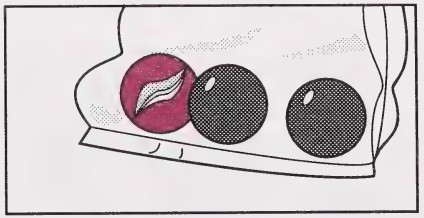
$$P(black) = \frac{1}{3} \quad \text{or} \quad P(black) = \frac{1}{3} \quad \text{or} \quad P(black) = \frac{1}{3}$$
$$= 0.\dot{3} \qquad = 33\frac{1}{3}\%$$

The probability of picking a black marble is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

$$P(white) = \frac{1}{3} \quad \text{or} \quad P(white) = \frac{1}{3} \quad \text{or} \quad P(white) = \frac{1}{3}$$
$$= 0.\dot{3} \qquad = 33\frac{1}{3}\%$$

The probability of picking a white marble is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

Example 3



There are three marbles in a bag: one red and two black.

The marbles are identical except for colour. If you pick one marble without looking, what is the probability of picking a black marble? What is the probability of choosing a red marble?

Solution

List the possible outcomes. Let one black marble be B_1, the second black marble be B_2, and the red marble be R.

B_1
B_2
R

The marbles are identical except for colour and the draw is made without looking. So, the possible outcomes are equally likely to occur and the formula can be used.

$$P(black) = \frac{2}{3} \quad \text{or} \quad P(black) = \frac{2}{3} \quad \text{or} \quad P(black) = \frac{2}{3}$$
$$= 0.\dot{6} \qquad = 66\frac{2}{3}\%$$

So, the probability of picking a black marble is $\frac{2}{3}$, $0.\dot{6}$, or $66\frac{2}{3}\%$.

$P(red) = \frac{1}{3}$ or $P(red) = \frac{1}{3}$ or $P(red) = \frac{1}{3}$

$= 0.\dot{3}$ $= 33\frac{1}{3}\%$

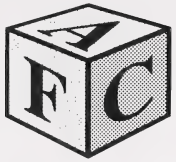
So, the probability of picking a red marble is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

Note: The probability of picking a black marble is twice that of picking a red marble.

Practice Activity 2

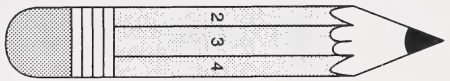
For each of the following, find the theoretical probability. Then try repeating each experiment 20 times. How close to the theory do you come?

1. A cube with the letters A, B, C, D, E, and F is tossed on a table.



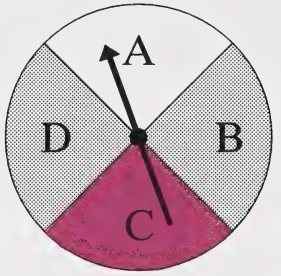
   a. What is the probability that the letter A will appear on top?
   b. What is the probability that a vowel will appear on top?
   c. What is the probability that a number will appear on top?
   d. What is the probability a letter will appear on top?

2. Each side of a pencil is labelled with one of these numbers: 1, 2, 3, 4, 5, or 6. The pencil is rolled on a table.



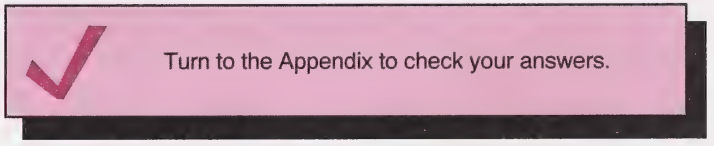
   a. What is the probability that the number 3 will land on top?
   b. What is the probability that a number less than 3 will land on top?
   c. What is the probability that an even number will land on top?

3. This spinner is twirled.



   a. What is the probability that the spinner lands on the white region if landing on a line is not counted?
   b. What is the probability that the spinner lands on a grey region if landing on a line is not counted?
   c. What is the probability that the spinner lands on the grey region labelled B, if landing on a line is not counted?

4. There are 2 white socks and 3 black socks in a drawer. The socks are identical except for the colour. If you pick one sock without looking, what is the probability that it will be white?



Working Together

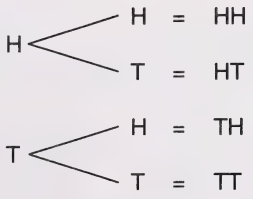
Sometimes tree diagrams are helpful in counting the number of possible outcomes and the number of favourable outcomes.

Example 1

If you toss a penny and nickel, what is the chance you will toss two heads?

Solution

Make a tree diagram. Let heads be H and tails be T.



There are four ways for the coins to turn up: HH, HT, TH, and TT. The possible outcomes are equally likely to occur. So, the formula can be used.

$$P(\text{two heads}) = \frac{1}{4} \quad \text{or} \quad P(\text{two heads}) = \frac{1}{4} \quad \text{or} \quad P(\text{two heads}) = \frac{1}{4}$$
$$= 0.25 \qquad = 25\%$$

So, the probability of two heads occuring is $\frac{1}{4}$, 0.25, or 25%.

Note: You can try an experiment to see how close to the theory your tosses come. Keep track of your tosses in a table like this.

Coin Tosses		
Outcome	**Tally**	**Frequency**
HH		
HT		
TH		
TT		

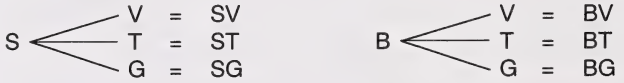
Example 2

The YMCA offers swimming and badminton on Tuesdays. On Thursdays volleyball, tennis, and gymnastics are offered.

Jason wants to register in a Tuesday class and a Thursday class. He likes all the sports equally. What is the probability that he will register in swimming and tennis?

Solution

Make a tree diagram. Let swimming be S, badminton be B, volleyball be V, tennis be T, and gymnastics be G.



Jason likes all the sports equally. So, all the outcomes are equally likely to occur, and the formula can be used.

$$P(\textit{swimming and tennis}) = \frac{1}{6} \quad \text{or} \quad P(\textit{swimming and tennis}) = \frac{1}{6}$$
$$= 0.1\dot{6}$$

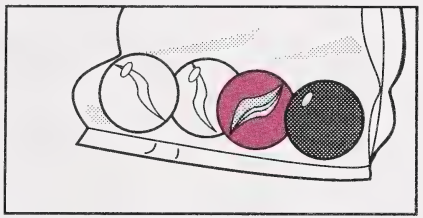
$$\text{or} \quad P(\textit{swimming and tennis}) = \frac{1}{6}$$
$$= 0.1\dot{6}$$
$$= 16\frac{2}{3}\%$$

So, the probability that Jason will register in swimming and tennis is $\frac{1}{6}$, $0.1\dot{6}$, or $16\frac{2}{3}\%$.

Note: You can simulate the situation by tossing a coin and twirling a spinner. Let heads represent swimming and tails represent badminton. Let the spinner have three regions of equal sizes to represent volleyball, tennis and gymnastics. How close to the theory do you come?

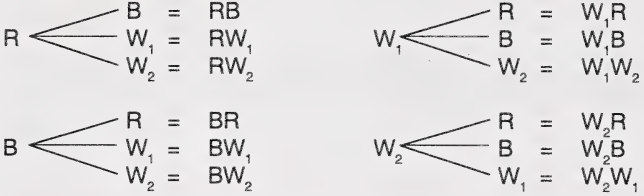
Example 3

There are one red marble, one black marble, and two white marbles in a bag. The marbles are identical except for colour. If two marbles are drawn without looking, what is the probability that one black marble and one white marble will be drawn?



Solution

Make a tree diagram. Let the red marble be R, the black marble be B, the first white marble be W_1, and the second white marble be W_2.



The favourable outcomes are BW_1, BW_2, W_1B, and W_2B.

Note: There are only three marbles in the bag after the first marble is picked.

The marbles are identical except for colour and the draw is made without looking. So, the formula can be used.

$$P(\textit{black and white}) = \frac{4}{12} \quad \text{or} \quad P(\textit{black and white}) = \frac{4}{12}$$
$$= \frac{1}{3} \qquad\qquad = \frac{1}{3}$$
$$= 0.\dot{3}$$

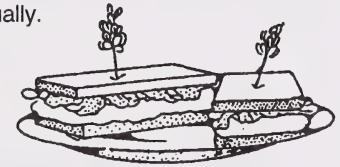
$$\text{or} \quad P(\textit{black and white}) = \frac{4}{12}$$
$$= \frac{1}{3}$$
$$= 33\frac{1}{3}\%$$

So, the probability of choosing one black and one white marble is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

Practice Activity 3

Print Alternative

1. Karl is ordering a sandwich. He has the choice of white or brown bread, toasted or plain, and lettuce or sprouts. He likes all choices equally.



   a. What is the probability that Karl will order a sandwich on brown bread, toasted, with lettuce?

   b. What is the probability that Karl will not order sprouts?

2. The letters M, A, T, and H are written on squares of paper and put in a bag. If two letters are picked without looking, what is the probability that both letters are consonants?

3. a. What is the probability that the children in a three-child family are three girls?

   b. What is the probability that the children are two boys and a girl?

Computer Alternative

4. Do program 15, "Probable Urnings", on Disk C of *Mathematics Activities Courseware* 8 (Houghton-Mifflin).

Turn to the Appendix to check your answers.

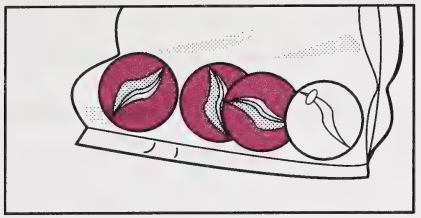
Working Together

Odds

Chance is often expressed as odds, especially in games and sports. **Odds** are the number of favourable outcomes to the number of nonfavourable outcomes.

Example 1

There are 4 marbles in a bag: 3 red and 1 white. What are the odds of picking a red marble?



Solution

There are 3 ways to obtain a red marble. There is 1 way not to obtain a red marble.

So, the odds of picking a red marble are 3 to 1.

Example 2

A cube with the letters A, B, C, D, E, and F is tossed on a table. What are the odds that a vowel will appear on top?

Solution

There are 2 ways to obtain a vowel: picking A or E. There are 4 ways not to obtain a vowel: picking B, C, D, or F.

The odds that a vowel will land on top are 2 to 4.

2 to 4 = 1 to 2

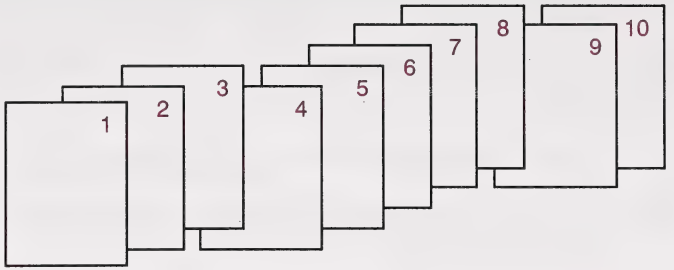
So, the odds that a vowel will land on top are 1 to 2.

Relating Odds to Probability

Odds can be expressed as a probability and a probability can be expressed as odds.

Example 1

The numbers 1 through 10 are written on separate cards. The cards are then mixed. The odds of picking a number less than 4 are 3 to 7. Express the odds as a probability.



Solution

The odds of 3 to 7 mean that there are 3 favourable outcomes to 7 nonfavourable outcomes.

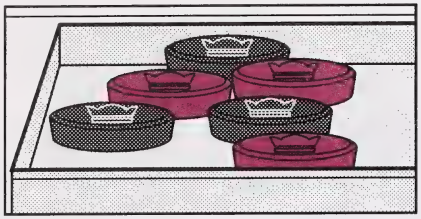
$3 + 7 = 10$

There are 3 favourable outcomes to 10 possible outcomes.

So, the probability of picking a number less than 4 is $\frac{3}{10}$.

Example 2

A box contains 3 black checkers and 3 red checkers mixed together. If you draw 2 checkers without looking, the probability that they will match is $\frac{12}{30}$ or $\frac{2}{5}$. Express the probability as odds.



Solution

$\frac{2}{5}$ means that there are 2 favourable outcomes out of 5 possible outcomes.

$$1-\frac{2}{5}=\frac{3}{5}$$

$\frac{3}{5}$ means there are 3 nonfavourable outcomes out of 5 possible outcomes.

There are 2 favourable outcomes to 3 nonfavourable outcomes.

So, the odds are 2 to 3 that the event will happen.

Practice Activity 4

1. Write these odds as probabilities.

a. The odds are 3 to 2 that the Blue Jays will win tonight's game.

b. The odds of Millie getting a strike are 1 to 3.

c. The odds of drawing a red cube from a box with some red, blue, and green cubes are 5 to 7.

2. Write these probabilities as odds.

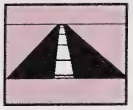
a. The probability of the Flames winning tonight's game is $\frac{1}{4}$.

b. The probability of rain is $\frac{2}{3}$.

c. The probability that Jason will win the election is $\frac{5}{12}$.

Turn to the Appendix to check your answers.

MODULE CONCLUSION



What Lies Ahead

In the module conclusion you will review the module and do the module assignment.

Working Together

In Module 7 you learned these skills.

- finding frequency and percent distribution
- counting frequency with tallies
- recording frequencies in tables
- interpreting pictographs, bar graphs, line graphs, and circle graphs
- recognizing graphs that misrepresent data
- finding mean, median, and mode
- finding range
- finding percentile
- interpreting a population and census methods
- interpreting a sample and sampling methods
- estimating properties of a population from sample results
- interpreting data from past records, surveys, experiments, and simulations to estimate the probability of future events
- calculating the probability of future events

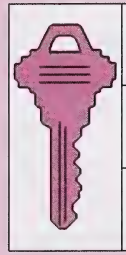
Now that you have studied Module 7, you should be ready to do the assignment for Module 7.

Module Assignment

Turn to the Assignment Booklet and complete the Module Assignment. You may use your notes, but do the assignment independently.

Afterwards, submit the assignment for a grade and feedback from your learning facilitator.

APPENDIX



- Glossary
- Suggested Answers
- Pull-out Sheets

Glossary

Bar graph: a diagram consisting of bars that represent data

Biased sample: a sample that is not representative of a whole population

Census: a count or measure of a property of a population

Circle graph: a diagram in which a circle represents a whole and portions of the circle represent parts

Frequency: the number of times a particular action or event has occurred

Line graph: a diagram in which a line containing points represents data

Mean: the arithmetic average of a set of numbers

Median: the middle number of a set of numbers, or the arithmetic average of the two middle numbers when the numbers are listed in order

Mode: the number that occurs the most in a set of numbers

Odds: the number of favourable outcomes to the number of nonfavourable outcomes

Percentile: a value on a scale of 100 that indicates the percent of a distibution that is equal or below it

Pictograph: a diagram that uses pictures to display data

Population: an entire set or group from which data is collected

Probability: a number between 0 and 1 or 0% and 100% that tells how likely it is that a certain event will happen

Random sampling: the selection of a sample so that each member of the population has an equal chance of being chosen

Range: the difference between the greatest value and least value in a distribution

Sample: a part of the population

Simulation: a procedure for answering questions about real problems by running experiments that closely resemble the real situation

Tally: a symbol used for counting

𝍸	means 3
𝍸	means 5
𝍸 𝍸	means 6

Suggested Answers

Section 1: Pretest

See your learning facilitator to check your answers.

Section 2: Practice Activity 1

1. The tallies are easy to make and organize into fives.

2.

Racing Cars Advertised		
Kind of Car	**Tally**	**Frequency**
BMW	I	1
Corvette	III	3
Jaguar	II	2
Mercedes	I	1
Mustang	II	2
Nissan	I	1
Porsche	IIII	4
Other	~~THL~~	5

3. **a.** 382

b. 369

c. D. Albrecht: about 32%
K. Busenius: about 43%
M. Stoik: about 20%
Undecided: about 5%

4. **a.** Toronto's airport was busiest in 1985.

b. Yes, the Vancouver airport handled more passengers.

c. 725 000 – 400 000 = 325 000

Vancouver's airport handled about 325 000 more passengers than Calgary's airport in 1985.

5. **a.** 750 000

b. 3 100 000

c. 1 600 000

d. 3 900 000 – 750 000 = 3 150 000

About 3 150 000 more people lived in Toronto than in Calgary in 1991.

6. **a.** In 1981 houses cost the most in Vancouver.

In 1987 houses cost the most in Toronto.

b. House prices decreased about $10 000 in Vancouver between 1981 and 1987.

c. House prices increased about $100 000 in Toronto between 1981 and 1987.

7. **a.** Canada

b. Canada, Great Britain, Soviet Union, United States

c. Canada: 5
Great Britain: 1
Soviet Union: 6
United States: 2

8. **a.** The plane lifted off 45 s after starting.
b. 125 km/h
c. 275 km/h

9. **a.** Toronto
b. Edmonton
c. Edmonton

10. a. Saskatchewan

b. 18 800 000 + 1 275 000 + 4 450 000 + 7 325 000 = 31 850 000

About $31 850 000 worth of wheat was produced in 1986.

c. Saskatchewan: about 59%
Alberta: about 23%
Manitoba: about 14%
Others: about 4%

Section 2: Practice Activity 2

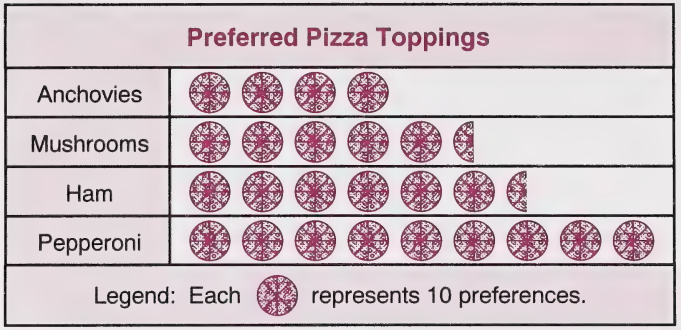
1. a. Instead of using a picture to represent every 10 pizzas, different-sized pictures are used to represent the different frequencies.

The number of people who prefer pepperoni is 2.25 times the number of people who prefer anchovies. However, the picture representing the people who prefer pepperoni is twice as wide and twice as high, so it appears much greater.

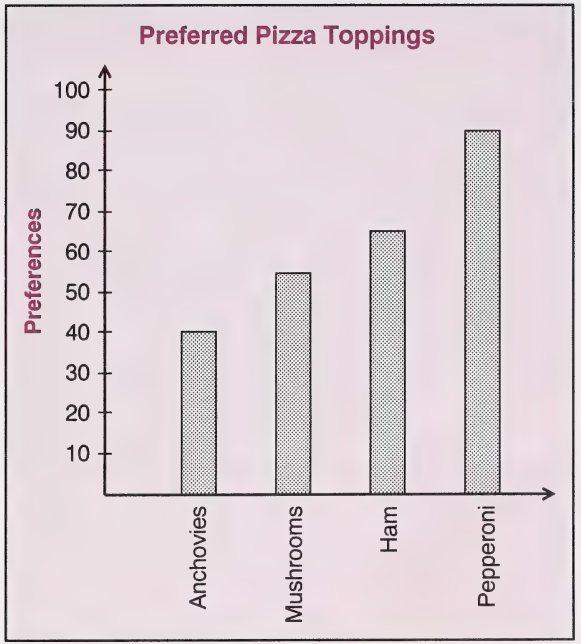
b. Because the scale on the vertical axis is broken, the height of the bars are out of proportion.

The height of the pepperoni bar should be 2.5 times the height of the anchovies bar. Instead the height of the pepperoni bar is 6 times the height of the achovies bar.

2. a.



b.



Section 3: Practice Activity 1

Print Alternative

1. a. $(43.9 + 40.9 + 38.9 + 3 \times 39.9 + 44.9 + 37.9 + 41.9) \div 9 = 40.9$

The mean is 40.9 ¢/L.

b.

37.9	39.9	41.9
38.9	39.9	43.9
39.9	40.9	44.9

The median is 39.9 ¢/L.

c. The mode is 39.9 ¢/L.

d. $44.9 - 37.9 = 7$

The range is 7 ¢/L.

2. a. $150\,000 + 100\,000 + 85\,000 + 53\,000 + 48\,000 + 40\,000 + 40\,000 + 40\,000 = 556\,000$

$$\frac{556\,000}{8} = 69\,500$$

The mean is $69 500.

b. $$\frac{53\,000 + 48\,000}{2} = 50\,500$$

The median is $50 500.

c. The mode is $40 000.

d. $150\,000 - 40\,000 = 110\,000$

The range is $110 000.

e. The salaries have a wide range, so the median is most representative.

3. a. $$\frac{(12 \times 0) + (6 \times 1) + (4 \times 2) + (2 \times 3) + (1 \times 4) + (1 \times 5)}{26}$$

$$= \frac{0 + 6 + 8 + 6 + 4 + 5}{26}$$

$$= \frac{29}{26}$$

$\doteq 1$

The mean is about 1.

b.

0	0	0	1	1	2	4
0	0	0	1	1	2	5
0	0	0	1	2	3	
0	0	0	1	2	3	

The median is 1.

c. The mode is 0.

d. $5 - 0 = 5$

The range is 5 fillings.

Computer Alternative

4. computer corrected

Section 3: Practice Activity 2

1. a. Of the 100 students, 99 students have fewer sisters and brothers. Jeanna is in the 99th percentile.

b. Of the 100 students, 90 students have fewer brothers and sisters. Norman is in the 90th percentile.

2. a. Of the 25 measurements, 20 were lower.

$$\frac{20}{25} = \frac{80}{100}$$

The measurement on September 12 was in the 80th percentile.

b. Of the 25 measurements, 9 were lower.

$$\frac{9}{25} = \frac{36}{100}$$

The measurement on September 25 was in the 36th percentile.

3. a. 80th percentile
b. 73%

4. a. $50 - 17 = 33$

$$\frac{33}{50} = \frac{66}{100}$$

Andrea's score is in the 66th percentile.

b. 60 students out of 100 students scored lower.

$$\frac{60}{100} = \frac{30}{50}$$

30 out of 50 students scored lower. Carla's rank is 20th.

Section 4: Practice Activity 1

1. The population is the children at the elementary school in Mia's town. The property being counted is the number of elementary children who go to school without eating breakfast.

Answers will vary on how the census could be conducted. One way is to conduct interviews of all the students. Another way is to pass out questionnaires to all the students.

2. The population is the earthworms in Ralph's garden. The property being counted is the number of earthworms. Answers will vary on how the census could be conducted. One way is to divide the garden into squares, dig up each square, and count all the earthworms.

3. a. Census takers drop off questionnaires at every household in Canada before census day. They return after census day and collect the questionnaires. The results are entered into computers.

b. Answers will vary, depending on the year researched. In 1991 the census cost over $250 000 000.

c. The data are used to determine electoral boundaries, federal payments to the provinces, provincial payments to cities, and to formulate social and economic policies and in planning for schools, hospitals, and transportation systems.

d. Although the census is quite accurate, it is not 100% accurate. Some households are missed and not all homeless people are counted.

Section 4: Practice Activity 2

1. The sample is biased because each person in the population does not have an equal chance of being chosen. People entering or leaving a swimming pool are probably swimmers.

2. The sample is biased because each person in the population does not have an equal chance of being chosen. Only students from one junior high school are questioned.

3. Not every person in Calgary has a telephone, so the sample is biased.

4. When survey forms are returned voluntarily, the results are often biased. People who feel strongly on one side of the issue or another may reply, but others may not.

5. The bighorn sheep only lives in certain areas of the province. The sections drawn at random may not include any bighorn sheep. It would be preferable to divide the regions where the bighorn sheep live into regions and then take samples.

6. At dinner parties, people often sit in a male, female, male pattern. By asking every second person, only the men or only the women could be polled, so the sample would be biased.

Section 4: Practice Activity 3

1. $\frac{15}{3} = \frac{x}{60}$

$900 = 3x$

$300 = x$

There are probably 300 potatoes in 60 hills.

2. No, the sample is too small to give accurate results.

3. $\frac{2}{25} = \frac{x}{1000}$

$2000 = 25x$

$80 = x$

In the batch, 80 are likely to be defective.

Section 5: Practice Activity 1

1. $P(\textit{successful free throws}) = \frac{33}{50}$ $\qquad \frac{33}{50} = \frac{66}{100}$

$= 0.66$ or 66%

Based on the past record, the probability is $\frac{33}{50}$, 0.66, or 66%.

2. a. Answers will vary. Here is one solution for an experiment with 20 tosses.

Tetrahedron Toss		
Number	**Tally**	**Frequency**
2	𝍸	5
4	𝍸	5
6	𝍸	5
8	𝍸	5

$P(4) = \frac{5}{20}$ $\frac{1}{4} = 0.25$ or 25%

$= \frac{1}{4}$

The probability is $\frac{1}{4}$, 0.25, or 25%.

b. Answers will vary. Here is one solution for an experiment with 20 tosses.

Tetrahedron Toss		
Number	**Tally**	**Frequency**
1	𝍸	5
4	𝍸 𝍸	10
7	𝍸	5

$P(4) = \frac{10}{20}$ $\frac{1}{2} = 0.5$ or 50%

$= \frac{1}{2}$

The probability is $\frac{1}{2}$, 0.5, or 50%.

3. Answers will vary. Here is one solution with 36 twirls of the spinner.

Simulation		
Birth Month	**Tally**	**Frequency**
January	III	3
February	III	3
March	III	3
April	III	3
May	III	3
June	III	3
July	III	3
August	III	3
September	III	3
October	III	3
November	III	3
December	III	3

$P(January) = \frac{3}{36}$ $\frac{1}{12} = 0.083\dot{3}$ or $8\frac{1}{3}\%$

$= \frac{1}{12}$

The probability is $\frac{1}{12}$, $0.083\dot{3}$, or $8\frac{1}{3}\%$.

4. $P(motor\ vehicle) = \frac{3798}{13\,057}$ $\frac{3798}{13\,057} \doteq 0.29$ or 29%

Based on past records, the probability that an accidental death in Canada is caused by a motor vehicle accident is $\frac{3798}{13\,057}$, or about 0.29, or about 29%.

5. $P(VCR) = \frac{40}{50}$ $\frac{4}{5} = 0.8$ or 80%

$= \frac{4}{5}$

The probability that a family will have a videocassette player is $\frac{4}{5}$, 0.8, or 80%.

Section 5: Practice Activity 2

For each of the following, the results of the experiments will vary. However, if the experiments are conducted a number of times, the results will be close to the theoretical probability.

1. **a.** $P(A) = \frac{1}{6}$ $\frac{1}{6} = 0.16\dot{6}$ or $16\frac{2}{3}\%$

The probability of A appearing on top is $\frac{1}{6}$, $0.16\dot{6}$, or $16\frac{2}{3}\%$.

b. $P(A\ or\ E) = \frac{2}{6}$ $\frac{1}{3} = 0.\dot{3}$ or $33\frac{1}{3}\%$

$= \frac{1}{3}$

The probability of a vowel appearing on top is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

c. $P(a\ number) = \frac{0}{6}$ $0 = 0\%$

$= 0$

The probability of a number appearing on top is 0 or 0%.

d. $P(a\ letter) = \frac{6}{6}$ $1 = 100\%$

$= 1$

The probability of a letter appearing on top is 1 or 100%.

2. **a.** $P(3) = \frac{1}{6}$ $\frac{1}{16} = 0.16\dot{6}$ or $16\frac{2}{3}\%$

The probability of 3 appearing on top is $\frac{1}{6}$, $0.16\dot{6}$, or $16\frac{2}{3}\%$.

b. $P(1\ or\ 2) = \frac{2}{6}$ $\frac{1}{3} = 0.\dot{3}$ or $33\frac{1}{3}\%$

$= \frac{1}{3}$

The probability of a number less than 3 landing on top is $\frac{1}{3}$, $0.\dot{3}$, or $33\frac{1}{3}\%$.

c. $P(2,\ 4,\ or\ 6) = \frac{3}{6}$ $\frac{1}{2} = 0.5$ or 50%

$= \frac{1}{2}$

The probability of an even number landing on top is $\frac{1}{2}$, 0.5, or 50%.

3. a. $P(white) = \frac{1}{4}$ $\frac{1}{4} = 0.25$ or 25%

The probability of landing on white is $\frac{1}{4}$, 0.25, or 25%.

b. $P(grey) = \frac{2}{4}$ $\frac{1}{2} = 0.5$ or 50%

$= \frac{1}{2}$

The probability of landing on grey is $\frac{1}{2}$, 0.5, or 50%.

c. $P(B) = \frac{1}{4}$ $\frac{1}{4} = 0.25$ or 25%

The probability of landing on B is $\frac{1}{4}$, 0.25, or 25%.

4. $P(white) = \frac{2}{5}$ $\frac{2}{5} = 0.4$ or 40%

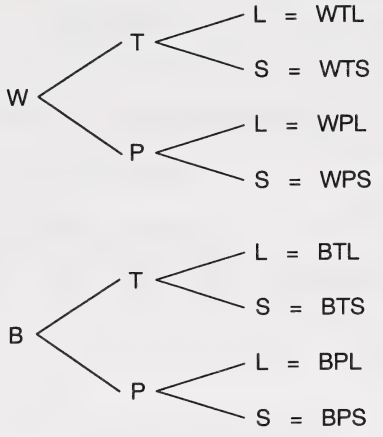
The probability of picking a white sock is $\frac{2}{5}$, 0.4, or 40%.

Section 5: Practice Activity 3

Print Alternative

Make a tree diagram. Let white bread be W, brown bread be B, toasted bread be T, plain bread be P, lettuce be L, and sprouts be S.

1.



a. $P(BTL) = \frac{1}{8}$ $\frac{1}{8} = 0.125$ or $12\frac{1}{2}\%$

The probability is $\frac{1}{8}$, 0.125, or $12\frac{1}{2}\%$.

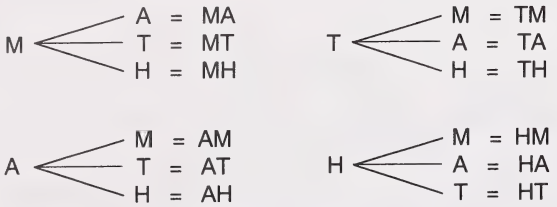
b. $P(no\ sprouts) = \frac{4}{8}$ $\frac{1}{2} = 0.5$ or 50%

$= \frac{1}{2}$

The probability is $\frac{1}{2}$, 0.5, or 50%.

Note: If Question 1 is done by simulation, the answers will vary.

2. Make a tree diagram.



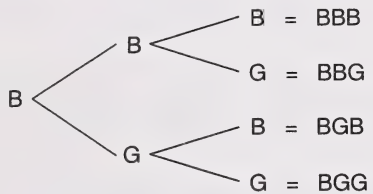
$P(\textit{two consonants}) = \frac{6}{12}$ $\frac{1}{2} = 0.50$ or 50%

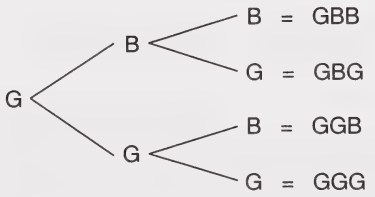
$= \frac{1}{2}$

The probability is $\frac{1}{2}$, 0.5, or 50%.

Note: If Question 2 is done by experiment, the answers will vary.

3. Make a tree diagram. Let a boy be B and a girl be G.





a. $P(\textit{three girls}) = \frac{1}{8}$ $\frac{1}{8} = 0.125$ or $12\frac{1}{2}\%$

The probability is $\frac{1}{8}$, 0.125, or $12\frac{1}{2}\%$.

b. $P(\textit{two boys and one girl}) = \frac{3}{8}$ $\frac{3}{8} = 0.375$ or $37\frac{1}{2}\%$

The probability is $\frac{3}{8}$, 0.375, or $37\frac{1}{2}\%$.

Note: If Question 3 is done by simulation, the answers will vary.

Computer Alternative

4. computer corrected

Section 5: Practice Activity 4

1. a. The odds of 3 to 2 mean that there are 3 favourable outcomes to 2 nonfavourable outcomes.

$3 + 2 = 5$

There are 3 favourable outcomes to 5 possible outcomes.

So, the probability that the Blue Jays will win tonight's game is $\frac{3}{5}$.

b. The odds of 1 to 3 mean that there is 1 favourable outcome to 3 nonfavourable outcomes.

$1 + 3 = 4$

There is 1 favourable outcome to 4 possible outcomes.

So, the probability that Millie will get a strike is $\frac{1}{4}$.

c. The odds of 5 to 7 mean that there are 5 favourable outcomes to 7 nonfavourable outcomes.

$5 + 7 = 12$

There are 5 favourable outcomes to 12 possible outcomes.

So, the probability that a red cube is drawn is $\frac{5}{12}$.

2. a. $\frac{1}{4}$ means that there is 1 favourable outcome to 4 possible outcomes.

$$1 - \frac{1}{4} = \frac{3}{4}$$

$\frac{3}{4}$ means that there are 3 nonfavourable outcomes to 4 possible outcomes.

There is 1 favourable outcome to 3 possible outcomes.

So, the odds that the Flames will win are 1 to 3.

b. $\frac{2}{3}$ means that there are 2 favourable outcomes to 3 possible outcomes.

$$1 - \frac{2}{3} = \frac{1}{3}$$

$\frac{1}{3}$ means that there is 1 nonfavourable outcome to 3 possible outcomes.

There are 2 favourable outcomes to 1 nonfavorable outcome.

So, the odds that it will rain are 2 to 1.

c. $\frac{5}{12}$ means that there are 5 favourable outcomes to 12 possible outcomes.

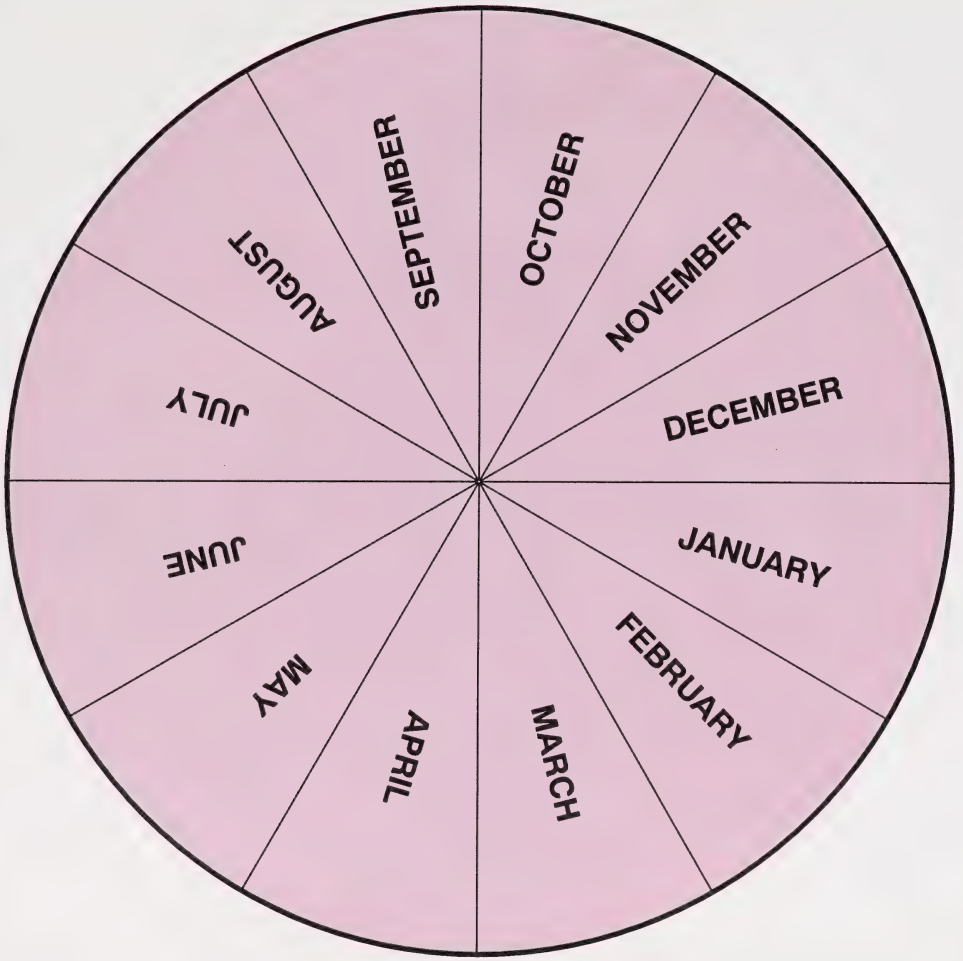
$$1 - \frac{5}{12} = \frac{7}{12}$$

$\frac{7}{12}$ means that there are 7 nonfavourable ourcomes to 12 possible outcomes.

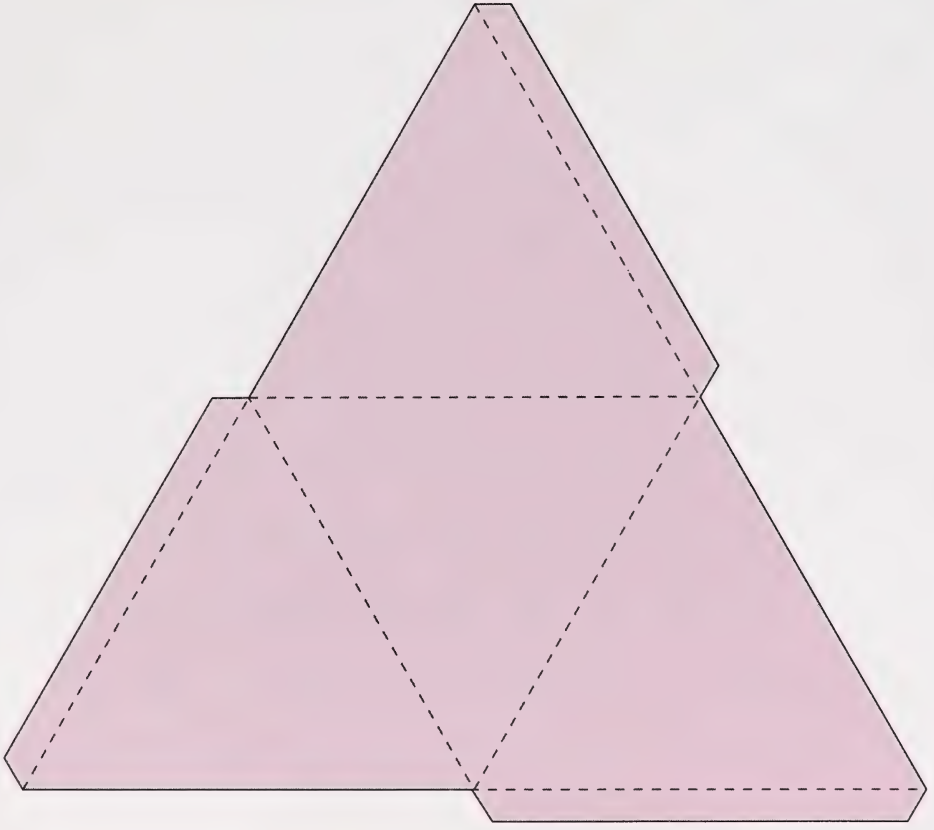
There are 5 favourable outcomes to 7 nonfavourable outcomes.

So, the odds that Jason will win are 5 to 7.

Spinner for Section 5



Net of Tetrahedron for Section 5



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